ELEMENTS OF CHEMISTRY,

AND

NATURAL HISTORY.

TO WHICH IS PREFIXED

THE PHILOSOPHY OF CHEMISTRY.

BY A. F. FOURCROY.

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BRITISH MUSEUM

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BRITISH
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MUSEUM

ELEMENTS OF NATURAL HISTORY AND CHEMISTRY.

PART IV.

CHAP IV.

Of Fat.

THE fat is a concrete oily matter, contained in the cellular tiſſue of animals. It is either white or yellowiſh, and commonly inſipid as to both taſte and ſmell. Its ſolidity, colour, taſte, &c. are different in different animals; nay, even in the ſame animal, as it is older or younger. In the infant it is white, inſipid, and far from ſolid; in the adult perſon, firm and yellowiſh; in the old man, of a deeper colour, very various in its conſiſtency, and generally of a ſtronger taſte.

The fat of man and quadrupeds is conſiſtent, and either white or yellow: The fat of birds is finer, ſweeter, more unctuous, and generally leſs ſolid: In cetaceous animals

nimals, and fiſhes, the fat is almoſt fluid, and frequently diſpoſed in certain reſervoirs, ſuch as the cavity of the cranium, and the vertebræ. It is found too in ſerpents, inſects, and worms; but in theſe animals it is confined to the viſcera in the lower part of the belly, where it is diſpoſed in ſmall lumps: only a very ſmall quantity or it is found on the muſcles, and under the ſkin.

It has been obſerved, that the fat of frugivorous and herbivorous animals is firm and ſolid, but that of carnivorous animals more or leſs fluid. It is, however, to be remarked on this head, that the fat muſt always be leſs ſolid, and leſs concrete, in a warm living animal, than in a dead carcaſe, cold, and under diſſection.

The fat of an animal is different in its nature in different parts of the body. About the reins, and under the ſkin, it is ſolid: It is leſs ſo between the muſcular fibres, or near the moveable viſcera, ſuch as the heart, the ſtomach, and the inteſtines. It is more copious in winter than in ſummer. It ſeems to contribute to the maintenance of heat in thoſe regions in which it is placed, as is proved by a great variety of facts that have been collected by phyſiologiſts. It ſeems even to contribute to the nouriſhment of animals, as has been obſerved of the bear, the marmot, the dormouſe, and of all thoſe animals in general which are occaſionally conſtrained to a long abſtinence; for, on ſuch occaſions, their greaſe is, by degrees, melted and waſted away.

Before uſing greaſe in the making up of medicines, or before examining its chemical properties; it ſhould be cut into pieces, and the membranes and veſſels running through it ſeparated from it: it is next to be plentifully waſhed with water, and melted with a little water in a new earthen veſſel. When the water is evaporated, and the boiling ceaſes, it may then be poured into another earthen veſſel, and ſuffered to cool.

All the chemical properties of greaſe have not yet been examined. Nothing but the power of fire, of air, and of ſome re-agents, on this ſubſtance is known: Yet there is ſcarce any animal matter with which we need more to be well acquainted, in order that ſome judgement may be formed of the uſes to which it is applicable, of which there is nothing certain hitherto known; as well as of the alterations which it is liable to ſuffer in living bodies.

The fat of any animal is liquefied by expoſure to gentle heat, and congealed by cooling. When expoſed to a ſtrong heat, with concourſe of air, it diffuſes a ſmoke of a poignant ſmell, which occaſions tears and coughing; and it burns, when expoſed to a heat ſufficient to volatilize it. It leaves but very little reſidual coal. Greaſe diſtilled on a water-bath, affords a vapid water, of a light animal ſmell, neither acid nor alkaline, but liable to take, in a ſhort time, a putrid ſmell, as alſo to depoſite mucilaginous filaments. This phenomenon, which takes place in all water obtained from animal ſubſtances by diſtillation on a water-bath, proves that the water carries off with it ſome mucilaginous principle to which the alteration muſt be owing. Animal fat diſtilled in a retort, affords a phlegm which is at firſt aqueous, but becomes afterwards ſtrong acid,—and oil that is partly liquid, partly concrete; and there remains a very ſmall quantity of reſidual coal, which it is not eaſy to incinerate, and in which M. Crell found a ſmall portion of calcareous phoſphate. Theſe products have an acid ſmell, lively and pungent, and as ſtrong as that of the ſulphureous acid. The acid is of a peculiar nature, and has been carefully examined by Mr Crell; but as it is exceedingly difficult to obtain it by diſtillation, that chemiſt employed a much ſurer and more expeditious proceſs: we will ſpeak of it afterwards. The concrete oil may be rectified by repeated diſtillation, ſo as to become highly fluid, volatile, and penetrating,—in a word, ſo as to exhibit all the characteriſtics of a genuine, eſſential or volatile oil. Twenty-eight ounces of human fat afforded Mr Crell twenty ounces, five drachms, and forty grains of fluid oil,—three ounces, three drachms, and thirty grains of ſebacic acid,—and three ounces, one drachm, and forty grains of bright coal, nearly in the ſame ſtate with plumbago or carbure of iron, as was remarked by M. de Morveau. In this analyſis, there were five drachms and ten grains loſt: That loſs muſt have been owing to the water in vapour, and the elaſtic fluids that were diſengaged, as Mr Crell did not make uſe of any pneumato-chemical apparatus.

Greaſe is very ſpeedily altered, when expoſed to the action of hot air: inſtead of continuing ſweet and inodorous, as when freſh, it becomes ſtrong and pungent in its taſte, and abſolutely rancid. This alteration appears to be a real fermentation, by which the acid is developed, and placed in a free ſtate. Although this acid, thus develloped, ſeems to be of the ſame nature with the ſebacic acid, I conſider not the change as owing ſolely to the oily part of the greaſe. The peculiar animal mucilage diſcoverable by a farther analyſis, may come in for its ſhare in this alteration. The rancidity of greaſe may be corrected in two ways: water itſelf, as has been obſerved by Mr Pœrner, is capable of carrying off all the acid that it contains; alkohol, according to M. de Machy, has alſo the ſame power. This proves that the acid of rancid greaſe reduces it into a ſort of ſaponaceous ſtate, in conſequence of which it becomes ſoluble in water and alcohol. Either of theſe fluids may be therefore confidently employed to reſtore rancid greaſe to is original ſtate.

When greaſe is waſhed with a great quantity of diſtilled water, the fluid diſſolves a gelatinous matter, the exiſtence of which appears upon evaporation; but the greaſe ſtill retains a certain portion of that matter intimately combined with it, on which its ſuſceptibility of fermentation depends. Farther, the power of water over this animal ſubſtance has not yet been accurately aſcertained.

Mr Crell, and the chemiſts of Dijon, have aſcertained in what manner alkaline ſubſtances act upon animal fat. Pure alkalis have long been known to form a ſort of ſoap with fat. Mr Crell, by treating that ſoap with a ſolution of alum, or aluminous ſulphate, ſeparated from it oil; and by evaporating the liquor, obtained ſebate of potaſh. This laſt ſalt he diſtilled with concentrated ſulphuric acid, which diſengaged the ſebacic acid. To ſeparate from this acid, the ſulphuric acid combined with it, Mr Crell adviſes to diſtil it again on a fourth part of the ſebate of potaſh, which muſt be reſerved for the purpoſe. To aſcertain whether it be entirely purified from ſulphuric acid, it may be aſſayed with acetite of lead. If the precipitate now formed be totally ſoluble in vinegar, it contains no ſulphuric acid. The chemiſts of the Academy of Dijon employ a ſimpler proceſs for obtaining the ſebacic acid: they melt the tallow, and, as it melts, throw into it quicklime: when this mixture becomes cool, they boil it in a large quantity of water: they next filtrate and evaporate the lixivium; and, by this means, obtain calcareous ſebate, which is brown and acrid. To purify this ſalt, it is calcined in a crucible, diſſolved, filtrated, and mixed with a juſt proportion of water containing carbonic acid, in order to ſeparate, by precipitation, the ſuperfluous lime: it is after this evaporated; and affords, by evaporation, a white ſalt, which is diſtilled with ſulphuric acid, to diſengage the ſebacic acid.

This acid may likewiſe be obtained by diſtillation from the butter of cacao, the white of the whale, and probably all fixed vegetable oils. The following are its characteriſtic properties: It is liquid and white, and its ſmell very lively: it exhales white fumes: it is decompoſable by fire, on which it becomes yellow, and affords carbonic acid: it converts blue colours to an high red: it unites with water in any proportion: with lime, it forms a cryſtallizable ſalt; with potaſh and ſoda, ſalts that cryſtallize in needles, and remain fixed in the fire. In union with the nitric acid, it diſſolves gold; it acts upon mercury and ſilver; it precipitates nitrate and acetite of lead; it decompoſes tartarite of potaſh, by precipitating the tartareous acidulum, or cream of tartar; it alſo decompoſes alkaline acetites. If ſtrongly heated with ſulphuric ſalts, it diſengages from them their acid in a ſulphureous ſtate; it precipitates nitrate of mercury and ſilver. A number of theſe properties had induced Mr Crell to think, that the ſebacic acid might poſſibly be nothing elſe but a modification of the muriatic acid; but M. de Morveau obſerves, that, as it decompoſes corroſive muriate of mercury, that property alone is ſufficient to diſtinguiſh it from the muriatic acid.

Mineral acids, in a concentrated ſtate, alter and burn greaſe. The ſulphuric acid turns it brown; the nitric acid gives it a lemon-yellow colour.

Sulphur combines very eaſily with fat, and forms with it a combination that has not been yet ſufficiently examined.

Greaſe is capable of diſſolving certain metals. It is united with mercury in the preparation known by the name of *mercurial pomatum.* To effect this union, all that is neceſſary is, to triturate the metal with hog's lard, for a conſiderable time. By this operation, the mercury is divided, attenuated, and united with the greaſe ſo intimately as to give it a ſlate colour, and no longer appears, therefore, in a metallic form. This union, however, is partly nothing but an extreme diviſion; or, at leaſt, only a part of the mercury is diſſolved by the ſebacic acid; for a magnifier ſhews the globules of the mercury ſtill exiſting naked even in the beſt-prepared ointment.

The three metals moſt liable to alteration by fat, are, lead, copper, and iron. The oxides of theſe metals, too, combine with it very readily. This is what makes it ſo dangerous, to ſuffer meats that have been prepared with fat to ſtand for any time in copper diſhes, or even in earthen diſhes glazed with lead-glaſs.—In combinations of animal fat with the oxides of metals, it is obſerved, that the oxides paſs eaſily, with the help of heat, into the metallic ſtate. This is owing to the combination of the hydrogenous gas diſengaged from the greaſe, with the oxigene of the oxides.

Almoſt all vegetable matters may be combined with fat. Extracts and mucilages render it, in ſome degree, ſoluble in water, or at leaſt contribute to its ſuſpenſion in that fluid. It combines with oils in any proportion, communicating to them a part of its own conſiſtency.

Theſe are all the chemical properties which this ſubſtance is known to poſſeſs. From conſidering them, it appears, that greaſe is nearly of the ſame nature with butter, being a fixed concrete oil, that owes to oxigene its ſolidity. This property has been imputed by all former chemiſts to an acid.

As to its uſes in the animal economy;—beſides maintaining heat in the parts around which it is diſpoſed, and giving an agreeable plumpneſs and roundneſs to the form, with a whiteneſs to the ſkin: Macquer thinks it likewiſe ſerves to abſorb the acids when too copious in the animal body, and regards it as the reſervoir of theſe ſalts. We are at leaſt certain, that when too much acid is is introduced into an animal body, it diſſolves and melts the fat, by communicating to it, no doubt, a ſaponaceous character, and rendering it more ſoluble.

Exceſs, and, ſtill more alterations of the fat, occaſion fatal diſtempers in the animal economy, the ſymptoms and effects of which are far from having been yet examined with ſufficient accuracy. Lorry has ſtudied them with particular attention; and has ſhewn, that there ſubſiſts a ſtriking analogy between this ſubſtance and the bile. This analogy is in fact founded on the fatty nature of the bile, on the colour that it frequently aſſumes in bilious complaints, on the ſolution and abſorption of the fat, in long continued affections of the liver; on the cruel practice of enlarging and ſoftening this viſcus in ſome fowls, by diſſolving their fat by long inaction combined with a dry and long continued heat, &c.

Fat is uſed as a ſeaſoning, and is nouriſhing to people who have ſtout ſtomachs. In medicine, it is applied externally, as ſoftening and calming; it enters into the compoſition of ointments and plaſters.

The marrow contained in the long bones, exhibits the ſame properties with the fat; but it has not yet been analyſed with ſuch accuracy as might enable us to deſcribe its characteriſtic properties.

CHAP. V.

Of the Bile and the Biliary Calculi.

THE bile or gall is a fluid, of a green colour, more or leſs yellowiſh, of a very bitter taſte, and of a nauſeous ſmell, that is ſeparated from the blood by a glandular viſcus, univerſally known by the name of the *liver*. In moſt animals, excepting inſects and worms, it is collected in a membranous reſervoir beſide the liver, called the *gall-bladder*. The human bile has been but little examined hitherto, on account of its being ſo difficult to procure a ſufficient quantity of it. It is on the cow's that chemical experiments have been made.

Its conſiſtency is nearly gelatinous or ſlimy: it runs into threads, like a tolerably clear ſyrup: when ſhaken, it froths like a ſolution of ſoap.

When diſtilled on a water-bath, it affords a phlegm that is neither acid nor alkaline, but liable to paſs, in a certain ſpace of time, into a putrid ſtate. I have often obſerved in this phlegm a ſingular property: I have found it to exhale a very diſcernible ſweet ſmell, nearly the ſame with that of muſk or amber. This experiment has been repeated a great many times in my laboratory. It ſucceeds beſt, in the diſtillation of bile that has been kept for ſome days, and is a little altered. When all the water that can be obtained from the bile on a water-bath is ſeparated from it, it is then found to be in the ſtate of an extract, more or leſs dry, and of a deep embrowned green colour. This extract of bile attracts moiſture from the atmoſphere: It is very tenacious and pitchy; it may be entirely diſſolved in water. By diſtillation in a retort, it affords a yellowiſh alkaline phlegm, an empyreumatic animal oil, a good deal of ammoniacal carbonate, an elaſtic fluid mixed with carbonic acid, and hydrogenous gas: After this operation, there remains a coal of a conſiderable bulk, which it is eaſier to incinerate than any that we have yet mentioned.—According to M. Cadet, who, in the years 1767, preſented to the Academy a moſt valuable Memoir on the Analyſis of the Bile, this coal contains carbonate of ſoda, an animal earth, and a ſmall portion of iron. It is to be obſerved, that the diſtillation of this ſubſtance muſt be ſlowly conducted; for it ſwells conſiderably. As to the ſalt, which M. Cadet takes notice of, as exiſting in the coal of the bile, and thinks to be of the ſame nature with ſugar of milk, it is eaſy to ſee, that ſuch a matter could not reſiſt the violent heat neceſſary to reduce the bile into a carbonaceous ſtate.

In a temperature of between 178°, 15′, and 223°, 15′, of heat, the bile is ſpeedily altered: Its ſmell becomes more nauſeous; its colour is altered and deſtroyed; whitiſh mucilaginous flakes are precipitated from it; it loſes its viſcidity, and ſoon after acquires a fœtid pungent ſmell: When nearly putrefied, its ſmell becomes ſweet, like that of amber. My pupil, M. Vauquelin, has diſcovered that the bile, after being heated on a water-bath, and thickened a little, will remain unaltered ſeveral months, in the ſame way as vinegar after being boiled. He has likewiſe diſcovered, that altered bile, which exhales a fœtid ſmell, and is of a brown colour, dirty, and turbid, loſes its ſmell when heated ; and that ſome concrete albuminous flakes are then ſeparated from it.

The bile diſſolves very well in water. Its colour then changes to a yellow, which is darker or brighter according as the quantity of the water added is ſmaller or greater.

All the acids decompoſe it in the ſame way as ſoaps: the combination formed is a coagulum. This mixture, filtrated and evaporated, affords a neutral ſalt, formed of the acid that has been employed, and ſoda. This beautiful experiment, for which we are indebted to M. Cadet, proves the exiſtence of ſoda in the bile. The matter that reſts on the filter, in theſe inſtances, is thick, viſcid, very bitter, and highly inflammable : its colour and conſiſtency are not always the ſame, but vary with the nature of the acid employed, and the degree in which it is concentrated. I have obſerved, that the ſulphuric acid gives it a deep green colour,—the nitric acid, a little concentrated, a bright yellow colour,—and the muriatic acid, a very beautiful light green ; but theſe colours vary greatly with the ſtate of the bile, and that of the acids. This precipitate is a ſubſtance ſimilar in its nature to reſins : On burning coals, it ſwells, melts, and takes fire : in alcohol, it is totally diſſolved ; and water precipitates it, like the reſinous juices. The action of acids on the bile ſhews, therefore, that this ſubſtance is a true ſoap, formed of an oil nearly of a reſinous nature, in union with ſoda. They prove alſo, that there exiſts in this animal liquor, a certain quanti- of albuminous matter. That matter is the cauſe of the coagulation of the bile by fire, by acids, by alcohol: and that ſame principle likewiſe produces its putrefaction.

Neutral ſalts, mixed with the bile, prevent it from paſſing into a ſtate of putrefaction.

Solutions of metals are decompoſed by the bile, which they likewiſe decompoſe. The fixed alkali of the bile unites with the acid of the ſolution; and the coloured oil of the bile is precipitated in combination with the metallic oxide.

The bile combines readily with oils, and takes them up, as well as ſoap, from ſtuffs.

The fluid is entirely diſſolved in alcohol; which ſeparates from it the albuminous matter. The tincture of the bile is not decompoſed by water; which ſhews this ſubſtance to be a true animal ſoap, equally ſoluble in aqueous and ſpiritous menſtrua. Æther very eaſily diſſolves it.

Vinegar decompoſes the bile, as well as the mineral acids. The liquor, filtrated and evaporated, affords acetite of ſoda in regular cryſtals.

From theſe ſeveral facts it follows, that the bile is a compound, conſiſting of a good deal of water, a peculiar aroma, an albuminous mucilage, a particular concreſcible oil, and carbonate of ſoda. M. Cadet relates, that he found it to contain a ſalt, which he thinks to be of the ſame nature with ſugar of milk; and the exiſtence of that ſalt has been ſince confirmed by M. Van Bochaute. But it is probable, that this pretended ſaline ſubſtance is rather analogous to the bright, cryſtalline, foliated ſubſtance which has been found by M. Poulletier in the biliary calculi of the human body, and of which we are about to ſpeak.

The bile, conſidered as it exiſts in the animal œconomy, is a juice which ſeems to promote digeſtion. Its ſaponaceous nature enables it to make oily matters combine with water. Its bitter taſte ſhews that it ſtimulates the inteſtines, and promotes their action on aliments. Roux, a celebrated phyſician and chemiſt of the Faculty of Paris, whoſe premature death has been no inconſiderable loſs to both theſe ſciences, thought that the principal uſe of the bile was to carry off from the body the colouring part of the blood. It appears to be decompoſed in the duodenum by the acids which almoſt always exiſt or are developed in the organs of digeſtion. It is certain, at leaſt, that it is greatly altered, eſpecially in colour, when it forms a part of the excrements. Skilful phyſicians, therefore, often draw very important inductions from an inſpection of theſe matters, concerning the ſtate of the bile in the inteſtines through which it is conducted, and of the liver by which it is ſeparated.

The extract of the gall of the ox, and of ſeveral other animals, is uſed as an excellent ſtomachic. It ſupplies the deficiency, and quickens the inactivity of the bile: it ſtrengthens the tone of the ſtomach, giving it, when weakened, new vigour to perform its functions. But it muſt be very cautiouſly uſed; for it is acrid and heating: it ſhould always, therefore, be given in very ſmall dozes, eſpecially to people whoſe nerves are delicate and eaſily irritated. Some aſcribe peculiar virtues to the gall of fiſhes; but the notion has not been confirmed by experience, and it is therefore to be ranked among the too numerous claſs of thoſe prejudices which diſgrace the materia medica.

Of the Biliary Calculi.

Whenever the bile of the human body is, by any cauſe, detained in the veſicle, eſpecially when it is detained by ſpaſmodic contractions, as in caſes of melancholy, or hyſterics, long-continued grief, &c. it becomes thick, and produces brown concretions, which are light, inflammable, and of a very bitter taſte, and are called *biliary calculi*. Theſe concretions are often very numerous; they diſtend the bladder, and ſometimes fill it up entirely. They occaſion violent hepatic pains, vomitings, jaundice, &c. I diſtinguiſh them into three varieties: Thoſe which I include under the firſt variety, are brown, blackiſh, irregular, tuberculous, and ſeem to conſiſt of lumps: Thoſe of the ſecond variety, are harder, brown, yellowiſh, or greeniſh, in concentric layers, and generally covered with a dry, uniform, grey cruſt;—their form is commonly angular and polyhædral: The third variety conſiſts of white, ovoidal concretions, more or leſs irregular in their form, covered with a whitiſh cruſt, ſcarce ever equally thick all over, in layers of a ſpathoſe appearance, or in tranſparent, cryſtalline plates, generally radiated from the centre to the circumference.

The biliary calculi of the ſecond variety have been examined by M. Poulletier de la Salle. He has obſerved them to be ſoluble in alcohol. On digeſting ſome of them in ſtrong ſpirit of wine, he remarked the liquor, at the end of a certain time, to be full of minute particles, brilliant and cryſtalline, and with all the appearances of a ſalt. The experiments which he made on this ſubſtance led him to ſuſpect that it might be an oily ſalt, in ſome of its properties reſembling the acid ſalt with which, under the name of flowers of benzoin, we are already acquainted; but it would appear that its nature is hitherto unknown. That philoſopher could find this ſalt only in the biliary calculi of the human body, not in thoſe of the ox. This very ſingular fact needs confirmation; for M. Vauquelin and I have found a ſmall quantity of lamellated matter in the biliary calculi of the ox.

M. Poulletier de la Salle's diſcovery has thrown light on ſome facts that were collected by the Royal Society of Medicine, concerning the ſtones formed in the gall-bladder. That Society received from their correſpondents, ſome biliary calculi belonging to the third of the above-mentioned varieties, which had not then been deſcribed. They conſiſted of maſſes of tranſparent, cryſtalline plates, preciſely of the ſame form with the matter diſcovered by M. Poulletier de la Salle. It even appears, that a large proportion of theſe cryſtals may be formed of the bile of the human body; for the Medical Society have, in their collection of calculi, a gall-bladder entirely full of this tranſparent ſaline concretion. I have two others of the ſame kind, which I received from my colleagues, Meſſrs le Preux and Hallé. On examining theſe cryſtallized biliary calculi, I have diſcovered them to be of an oily nature, ſimilar to the fat of a whale.

Soap, a mixture of æther and oil of turpentine, &c. have been propoſed as fit ſolvents for theſe biliary calculi. It is worthy of obſervation, that they are not found in the gall-bladder of the ox, unleſs after dry ſeaſons, and a ſcarcity of freſh forage, and diſappear again in Spring and Summer, when the animal is ſupplied with plenty of green, ſucculent vegetables. Butchers are well acquainted with this fact; they know, that between the month of November and the month of March theſe ſtones are found in the animals, and from March to November ceaſe to be found. This is a ſufficient proof of the power of the ſaponaceous juices of plants to diſſolve the biliary calculi. Yet, it is not to be thought that medicines, however active and volatile, can be conveyed into the gall-bladder in ſufficient quantity to act there with the ſame energy in diſſolving the biliary calculi as in our experiments. In my opinion, the ceſſation of ſpaſm, and conſequently the dilatation of the biliary canal, is the true cauſe of the good effects of the æthereal mixtures that have been propoſed by M. Durande, which I have elſewhere recommended to be made up without oil of turpentine;—with the more confidence, becauſe it is evident that the oil is both very heating, and produces no uſeful effect but that of diminiſhing the volatility of the æther; and it has been already proved by ſome obſervations, that yolks of eggs, and, no doubt, many other ſubſtances, will ſerve the purpoſe as well, without the ſame unfavourable effects.

CHAP. VI.

Of the Saliva, the Pancreatic Juice, and the Gaſtric Juice.

ANATOMISTS and Phyſiologiſts have obſerved a great reſemblance between the ſaliva and the pancreatic juice. The ſalivary glands, and the pancreas, are in fact preciſely of the ſame ſtructure; and the humours prepared by both theſe organs, appear to ſerve the ſame purpoſe. The human ſpecies and quadrupeds are the only animals that have ſaliva; at leaſt, ſcarce any other animals have yet been found to poſſeſs ſalivary glands.

Chemiſts have not yet made any accurate experiments on either of theſe fluids. The only reaſon that can be aſſigned for this, is its being ſo very difficult to procure even a very ſmall quantity of either. We know only, that the ſaliva is a very fluid juice, ſeparated by the parotides and many other glands, which is conſtantly flowing into the mouth, but moſt copiouſly during the act of maſtication. This humour appears to be of a ſaponaceous nature, and impregnated with air, which renders it frothy. When evaporated to dryneſs, it leaves but little reſidue: And yet concretions of the ſaliva are ſometimes formed in the ducts by which it is conveyed into the mouth. It appears to contain an ammoniacal ſalt; for, lime and cauſtic fixed alkalis diſengage from it a poignant urinous ſmell.—Pringle, from experiments which he made, concluded the ſaliva to be very ſeptic, and that it promoted digeſtion, by occaſioning a commencement of putridity in the maſticated aliments. Mr Spallanzani, and ſome other modern naturaliſts, think, again, that it poſſeſſes, in an eminent degree, the power of retarding and ſtopping putrefaction.

The gaſtric juice is ſeparated from the ſmall glands or extremities of the arteries that open into the internal tunic of the ſtomach. The œſophagus ſupplies alſo a ſmall portion of it, eſpecially in the inferior region: in this region, many birds are obſerved to have very large glands that open into very diſcernible excretory ducts. M. Vicq d'Azyr has carefully deſcribed thoſe which appear in the ſtork, *&c.*

Some modern naturaliſts have been at great pains in examining the gaſtric juice. Meſſrs Spallanzani, Scopoli, Monch, Brugnatelli, and Carminati, ſome years ago, examined the properties of this liquor. They procured it from the ſtomachs of ſheep and calves, by opening them after the animals had faſted for ſome time. They obtained it from carnivorous and gallinaceous birds, by making them ſwallow metal tubes, perforated with holes, and filled with very fine ſponge. Mr Spallanzani examined the gaſtric juice of his own ſtomach, by making himſelf vomit, and by ſwallowing tubes of wood filled with different ſubſtances, that he might judge of the effects of the gaſtric juice upon each of them. Experiments with tubes had been before tried by M. de Reaumur. Laſtly, M. Goſſe of Geneva has had the courage to make himſelf vomit many times, by a certain proceſs of his own, which conſiſts in ſwallowing air.—From all theſe modern obſervations, the gaſtric juice appears to poſſeſs the following properties:

This juice is the principal agent in digeſtion: It converts the aliments into a ſort of uniform ſoft paſte: It acts on the ſtomach even after the death of the animal: It acts as a ſolvent; but, what diſtinguiſhes it from all other ſolvents, is, that it acts indifferently on animal and vegetable ſubſtances, without ſhewing any preference, or any ſtronger affinity with the one than with the other. Far from having a tendency to promote fermentation, it is one of the moſt powerful antiſeptics known. As to its intimate nature,—it appears, from the experiments of the above-mentioned philoſophers, to be different in different claſſes of animals. According to Mr Brugnatelli, the gaſtric juice of birds of prey and granivorous birds is very bitter, and conſiſts of a diſengaged acid, reſin, animal matter, and common ſalt: That of ruminating quadrupeds is very aqueous, turbid, and ſaltiſh; it contains ammoniac, an animal extract, and common ſalt. M. de Morveau having digeſted ſome parts of the interior tunic of the ſtomach of a calf, in water, found it to diſplay an acid character. Mr Spallanzani thinks this character to be owing to the aliments on which the animal feeds: he never found the gaſtric juice of carnivorous animals, acid; that of granivorous animals, he found always ſo. M. Goſſe experienced the ſame thing in himſelf, after living long on raw vegetables. Mr Brugnatelli thinks, that the white matter of the excrements of carnivorous animals contains phoſphoric acid; but M. de Morveau obſerves, that his experiments are not concluſive. Mr Scopoli found in it ammoniacal muriate; and ſuſpects, that the muriatic acid is produced by the operation of the vital powers of animals: But he has no deciſive fact to ſupport this opinion; on the contrary, every fact concurs to evince that it proceeds from the aliments. Meſſrs Macquart and Vauquelin have found the gaſtric juice of the ox, the calf, and the ſheep, to poſſeſs invariably an acid character; but from the accurate experiments which they have made, it appears to derive this character from the phoſphoric acid in a naked ſtate. They have obſerved, too, that thoſe juices alter and putrefy even very ſpeedily. The gaſtric juice of carnivorous animals appears to poſſeſs antiſeptic powers in a more eminent degree.

From all theſe facts taken together, it may be inferred, 1. That the gaſtric juice is as yet but imperfectly known: 2. That it appears to be different in different claſſes of animals, and modified according to the diverſity of the aliments on which they live: 3. That we have yet no proof of its being a peculiar acid, or that we ſhould acknowledge the exiſtence of a gaſtric acid: 4. That its moſt remarkable properties are, a very extraordinary ſolvent power, which acts with ſufficient energy even on bony and metallic ſubſtances, and is even ſaid to be capable of attacking ſiliceous ſtones,—with a ſort of indifference on what matter it acts, and the ſame affinity with all matters.

Its extraordinary antiſeptic power, which it communicates to all bodies that are mixed with it, and which even ſtops putrefaction in ſubſtances in which that proceſs is already begun, has been more attended to than any of its other properties. Meſſrs Carminati, Jurine, and Toggia, have applied the gaſtric juice to wounds.

Mr. Carminati has even adminiſtered it internally; and they all agree with regard to its antiſeptic powers. But the experiments of Meſſrs Maquart and Vaquelin above mentioned, which were made in my own laboratory, prove, that the gaſtric juice of ruminating animals poſſeſſes no ſuch properties.

CHAP. VII.

Of the Humours or Animal Matters that have not yet been examined; ſuch as Sweat, the Mucus of the Noſe, the Cerumen, Tears, the Gum of the Eye, the Seminal Fluid, and the Excrements.

THERE are ſtill many animal fluids and matters that have not been examined: And therefore, rather with a view to engage young phyſicians in ſuch new and uſeful reſearches, than to explain their nature, we ſhall ſay ſomething of the humour which tranſpires by the pores,—the ſweat, the mucus of the noſtrils, the cerumen of the ears, the tears, the gummy matter of the eyes, the ſeminal fluid, and the excrements.

Phyſicians have diſcovered a great reſemblance between the humour which tranſpires by the pores, and the urine. They know that on many occaſions one of theſe excretions ſupplies the place of the other; and are therefore naturally led to conſider the vaporous fluid which tranſpires by the pores as of the ſame nature with urine. In the practice of medicine, its qualities are obſerved to be ſubject to variation: Its ſmell is faint, aromatic, alkaline, or ſour; its conſiſtency, ſometimes glutinous, thick, tenacious; and it leaves a reſidue on the ſkin: It frequently communicates to linen cloth, a yellow colour, of various ſhades. I have twice obſerved it to communicate to linen, and woollen ſtuffs, a ſparkling blue colour. M. Berthollet affirms, that ſweat reddens blue paper; and obſerves, that this phenomenon takes place chiefly on parts affected with the gout. He ſuppoſes it to contain phoſphoric acid. It has hitherto been found impoſſible to collect a ſufficient quantity of this excrementitial humour, for examining its properties carefully. A great many experiments, therefore, remain to be made on this matter, which only accidental and peculiar circumſtances can enable naturaliſts to undertake and proſecute.

The humour prepared by the membrane of Schneider, which is thrown out of the noſe by ſneezing, highly merits the attention of phyſicians. It is a ſort of thick mucilage, either white or coloured; in certain affections, eſpecially in catarrhs, more or leſs fluid or conſiſtent. It ſeems to be a mucous, alkaline ſubſtance, which becomes thick in conſequence of abſorbing oxigene from the atmoſphere.

We are unacquainted with the nature of that greeniſh yellow, or brown matter which gathers in the auditory canal, becomes thick, and is, from its conſiſtency, known by the name *cerumen*. It is very bitter: it ſeems to be of a reſinous nature: it is known to become ſometimes ſufficiently concrete to cloſe up the auditory canal, and hinder ſound from entering it freely: it ſeems to be ſomewhat of the ſame nature with the inflammable matter of the bile.

We know more of the tears which are prepared in a certain gland, ſituated near the external angle of the ſocket of the eye, and are deſigned by nature to maintain the moiſture and ſuppleneſs of the exterior parts. This liquor is clear, limpid, and diſcernibly ſaltiſh; it ſometimes runs very copiouſly: In the ordinary ſtate of the human frame, it runs by degrees into the noſtrils, and ſeems to ſerve the purpoſe of moiſtening the mucus. Moſt of the authors that have ſpoken of this liquor of tears, particularly Pierre Petit, a phyſician in Paris, who about the end of the laſt century, publiſhed a treatiſe on tears, conſider them as being nearly pure water. We have found them to contain a particular mucilage that grows thick by abſorbing oxigene, muriate of ſoda, and ſoda in a cauſtic ſtate; after that, this humour becomes ſimilar to the mucus of the noſe with which it mixes.

The chemical nature of the ſeminal fluid has not been more particularly examined than that of thoſe fluids above-mentioned. From the very few obſervations that have been made upon it, it appears to be nearly of the ſame nature with animal mucilages, to be liable to become fluid either by cold or heat, and to be reducible by the action of fire into a dry friable ſubſtance.

On this head, anatomical and microſcopical obſervations have gone much farther than chemical experiments. From theſe it appears, that the ſeminal fluid is a ſort of ocean, with ſmall round bodies ſwimming about in it with great rapidity of motion. Theſe are, by ſome conſidered as living animals intended for the reproduction of the ſpecies, and, by others, as organic particles which unite to produce a living animal. A late obſerver has likewiſe diſcovered, with the microſcope, cryſtals that are formed during the cooling and evaporation of the ſeminal fluid. It muſt be confeſſed, however, that theſe fine experiments have as yet contributed nothing to the advancement of the ſcience, and have only given ground for ſome ingenious hypotheſes.

M. Vauquelin has given in the Annals of Chemiſtry, (April 1791), a memoir on the human ſemen: the following are the new facts which it contains.

1. This ſubſtance has a faint odour, a ſharp, and ſomewhat aſtringent taſte; its weight is greater than that of water.

2. To aſcertain if the air be the cauſe of the liquefaction which takes place in this fluid ſoon after it has been emitted, he expoſed equal quantities of it in the open air, and in cloſe veſſels, which completely excluded this fluid. As liquefaction took place in both portions in the ſame manner and in the ſame time, he was thence led to conclude that neither air nor the ſubſtances diſſolved in it produced this effect.

3. When ſome ſeminal liquor was allowed to liquefy in a ſmall glaſs ball, that terminated in a very narrow tube, it acquired no increaſe of bulk. This was eaſily aſcertained by marking the place to which the fluid roſe. He ſeems to have had ſome ſuſpicion that this phenomenon was owing to caloric.

4. When ſome of this fluid was expoſed for ſome days to the air in a ſmall capſule, long, tranſparent cryſtals were depoſited in it, of the ſhape of a priſm with four ſides terminated by pyramids with four faces. According to the experiments of this author, theſe cryſtals, which had been announced before in the *Journal de Phyſique*, are a very pure phoſphate of lime.

5. After expoſure to the air for ſome time, there is formed on the ſeminal liquor a very thick pellicle, which is ſet with opaque white points. Theſe points are of

the ſame nature with the former cryſtals, and differ from them only in wanting tranſparency.

6. If the air in which the ſeminal fluid is expoſed be moiſt, it does not become quite dry, it continues ſoft and ductile. But, before arriving at this ſtate, it ſuffers ſeveral changes which the author has deſcribed with care. It takes a yellow colour; becomes acid; cryſtals are formed in it; and at laſt it exhales the ſmell of putrid fiſh. If, on the contrary, the air be warm and dry, the ſemen dries inſtantly, becomes hard and brittle like horn, and during this deſiccation it loſes $\frac{9}{10}$ of its weight.

7. The ſeminal liquor exhibits ſtrong proofs of the preſence of an alkali, which are owing to the ſoda that the author has diſcovered in it.

8. Water at whatever temperature, that is from the freezing to the boiling point, does not diſſolve ſemen that has not been previouſly liquefied: but after it has been liquefied, water combines with it at every temperature. This, M. Vauquelin obſerves, denotes ſome change either in the texture or organization, or in the internal nature of the ſemen, during its liquefaction.

9. All the acids, excepting the oxigenated muriatic acid, diſſolve the ſeminal liquor very readily. The alkalies cannot diſengage it afterwards in a ſolid ſtate. The oxigenated muriatic acid, inſtead of diſſolving it, reduces it to white flakes that afterwards become yellow, if the acid be added in large quantity. The urine, by means of its diſengaged acid, likewiſe diſſolves the ſeminal fluid.

10. The ſeminal fluid, when freſh, does not decompoſe the barytic ſalts, whilſt it decompoſes them after being

long expoſed to the air. This effect is produced by the carbonic acid of the atmoſphere, which is abſorbed by the ſoda contained in the ſemen, and which enables it to decompoſe the barytic ſalts. All the calcareous, magneſian, and aluminous ſalts are decompoſed by ſemen, becauſe ſoda has a ſtronger attraction for the acids than theſe earthy matters poſſeſs. The metallic ſalts are ſtill more readily decompoſed by this ſubſtance.

11. Dried ſemen, when diſtilled, furniſhed; 1. Some drops of water; 2. An elaſtic fluid, compoſed of carbonic acid, and carbonated hydrogenous gas; 3. An empyreumatic oil; 4. Ammoniacal carbonate; 5. There remained a very light coal in the retort.

12. To aſcertain the proportions of the ſubſtances which the former experiments had diſcovered in the ſemen, M. Vauquelin took 40 grains of dried ſemen, which correſponded to 400 grains of this fluid when freſh, ſince it loſes $\frac{9}{10}$ of its weight by drying, and heated them in a crucible of very pure white clay. This ſubſtance ſwelled, emitted yellowiſh ammoniacal fumes, and was converted into coal. When a ſtrong heat no longer diſengaged any thing from it, the crucible was removed from the fire, the coal which it contained was lixiviated, and the lixivium evaporated in the air furniſhed 8 grains of carbonate of ſoda, recogniſable by every property of this ſalt. The lixiviated coal was again expoſed to the fire; it burnt readily, and there remained 12 grains of a white cinder that had no taſte, that did not diſſolve in water, and that melted at the blowpipe into an opaque globule that ſhed a phoſphoric light, whilſt it continued in fuſion. This ſubſtance diſſolved in acids; its ſolution was precipitated in white

flakes by all the acids and by limewater. A ſolution of it in the muriatic acid, evaporated to dryneſs, and afterwards treated with ſtrongly rectified ſpirit of wine, was divided into two portions. One of theſe diſſolved in alkohol, furniſhed with the oxalic and the ſulphuric acid, precipitates of oxalate and ſulphurate of lime, and with potaſh, pure lime. The other portion which remained of a thick conſiſtence, was melted at the blowpipe into a tranſparent glaſs, ſoluble in water, and the ſolution of which precipitated lime water and reddened blue vegetable colours. This analyſis proves that this laſt ſubſtance is compoſed of lime and the phoſphoric acid like the baſis of bones.

From the preceding experiments it follows that the human ſemen is compoſed,

	Parts.
1. Of animal mucilage	6
2. Of ſoda - -	1
3. Of phoſphate of lime	3
4. Of water -	90 in the 100

The aliments which animals ſwallow, contain a great quantity of matter that cannot afford them nouriſhment, and is evacuated from the inteſtines in a ſolid form. The excrements are coloured by a portion of the bile, which they carry off with them. The fœtid odour which they exhale, is owing to their having begun to putrefy in their paſſage through the inteſtines. No chemiſt but Homberg has examined theſe matters. He obſerved the phlegm obtained from the excrements, by diſtillation on a water-bath, to have a nauſeous ſmell: by waſhing and evaporation, he obtained from them a ſalt which melted like nitre, and kindled voluntarily in cloſe veſſels.

This matter, by diſtillation in a retort, afforded the ſame products as other animal ſubſtances. From putrid excrements he obtained an oil deſtitute of colour and ſmell, which did not gratify his expectations of ſeeing mercury converted by it into ſilver.

It is to be obſerved, that the fecal matter examined by Homberg, was that of men fed upon coarſe bread and Champagne wine; which had been required as a condition neceſſary to the ſucceſs of the achemical experiment he had been directed to make. The food muſt doubtleſs peculiarize, in ſome degree, the nature of the excrements, as theſe are nothing but the reſidue of the food. An exact and careful analyſis of the excrementitious matters of different claſſes of animals, is one of the moſt certain means of diſcovering the phenomena of digeſtion. Several celebrated chemiſts are at preſent engaged in this purſuit.

CHAP. VIII.

Of Urine.

URINE is a tranſparent, excrementitial fluid, of a lemon-yellow colour, of a peculiar ſmell, of a ſaline taſte, ſeparated from the blood by two glandular viſcera that are called the reins, and from theſe conveyed into a reſervoir univerſally known by the name of the bladder, in which it remains for ſome time : it is a ſort of lixivium impregnated with the acrid matters of the animal humours, which, if too long retained in the body, might obſtruct and diſorder the functions of the ſyſtem.

Urine is a ſolution of a great number of ſalts, and two extractive matters. It varies in quantity and in qualities, according to circumſtances. That of the human ſpecies, which we propoſe to examine more particularly, differs from the urine of quadrupeds. Among other claſſes of animals the differences are ſtill greater. The ſtate of the ſtomach, and particularly the ſtate of the humours, produce an infinite diverſity of changes on this fluid ; to aſcertain and eſtimate which, a long ſeries of experiments would be requiſite, which have, as yet, only been pointed out as neceſſary. Here, therefore, we ſhall ſpeak only of human urine as it is emitted in a ſtate of health.

This fluid is, by good phyſicians, diſtinguiſhed into two ſorts. The one called crude urine, flows off ſoon after meals :

meals: it is clear, and almoſt entirely without taſte or ſmell: it is far from containing ſo many different principles as the other. It, again, is called urine of the blood, or of concoction, and is not emitted till after digeſtion: it is ſeparated from the blood by the reins; whereas the other ſpecies appears to filtrate, in part, from the ſtomach and the inteſtines, directly into the bladder, through the cellular tiſſue, or the abſorbent veſſels.

The ſtate of the health, and more eſpecially the diſpoſition of the nerves, modify the urine in a ſingular manner. After hyſteric or hypocondriac fits, it flows copiouſly; it is then inodorous, inſipid, and colourleſs. Diſeaſes of the bones and joints have conſiderable influence on this animal lixivium. It often depoſites a great quantity of matter, apparently earthy, but which, as we ſhall hereafter ſhew, conſiſts of lithic acid, and calcareous phoſphate. The ſediment of the urine of thoſe who have the gout is of this ſort. Phyſicians, particularly Heriſſant and Morand, have obſerved, that when the bones are altered or ſoftened, the urine depoſites a good deal of this matter. It even appears, that the urine of people in a good ſtate of health depoſites a quantity of this matter, which conſtitutes the baſis of bones; which is probably all of it that is formed in the body above what is requiſite for the nutrition and reparation of thoſe organs.

Many of the articles of food communicate ſome peculiar properties to the urine. Turpentine and aſparagus give it, the former a ſmell of violets, the latter a very fœtid ſmell. The urine of people of weak ſtomachs retains a ſmell of their food: bread, garlic, onions, ſoup, and all vegetables, communicate each its peculiar ſmell to the urine. From theſe particulars, it appears, that an obſervation of the phenomena which urine exhibits, may be of conſiderable uſe to the phyſician in the practice of his art. We muſt, however, beware of imagining that, from ſimple inſpection of the urine, it is poſſible for the phyſician to judge of the diſeaſe and ſex of the ſick perſon, and of the proper remedies; as ſome empirics pretend to do.

The urine of the human ſpecies, conſidered with reſpect to its chemical properties, is a ſolution of a great many different ſubſtances. Some of theſe are ſalts, ſimilar to thoſe of minerals, and, as Macquer thinks, proceed from the aliments, without alteration. Others of them are matters of the ſame nature with the extractive principles of vegetables: And laſtly, ſome appear peculiar to animals, and even to urine;—at leaſt, have not been found in any notable quantity among the products of the other kingdoms of nature, nor even in any other animal ſubſtances but urine. After explaining the proceſſes employed to extract theſe different matters from urine, we ſhall give the hiſtory of ſuch of them as are peculiar to the fluid, and therefore have not before come under our notice.

Urine uſed to be conſidered as an alkaline liquor, or lixivium; but M. Berthollet has remarked, that it always contains a greater quantity of phoſphoric acid than of any other ſalt, and reddens the tincture of turnſole*. This phyſician has obſerved, that the urine of gouty people always contains leſs acid ſalt than that of people in

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* Coldevillars had before aſſerted, in his *Courſe of Surgery*, that urine conſtantly reddened the tincture of turnſole.– F.

in a ſtate of perfect health; and that, during the fit of the gout, their urine is ſtill leſs acid than at other times. Hence he conjectures, that in gouty people the phoſphoric acid is not evacuated by the urine, as in people in perfect health; that it loſes its way, (if the expreſſion may be here uſed) and, being conveyed to the joints, there occaſions irritation and pain. This exceſs of acid in the urine appears to maintain in ſolution in it, a quantity of calcareous phoſphate.

Scheele thinks the acid of urine not to be altogether phoſphoric acid, but partly the ſame with the acid of the calculus in the human bladder, which we call the lithic acid. This acid being ſuſceptible of concretion and cryſtalliſation, forms according to that celebrated chemiſt, the red cryſtals that are depoſited in urine, as well as the brick-coloured precipitate obſerved in the urine of feveriſh perſons. The tophaceous concretions on the joints of gouty perſons, appear to be of the ſame nature with the calculus, that is, to conſiſt chiefly of lithic acid.

Freſh urine, diſtilled in the water-bath, affords a large quantity of a phlegm which is neither acid nor alkaline, but ſoon putrefies. As this phlegm contains nothing peculiar, urine is commonly evaporated by naked fire. In proportion as the water, which compoſes more than ſeven eights of this animal humour, is evaporated, the urine aſſumes a brown colour: there is ſeparated from it a pulverulent matter of an earthy appearance, which has been taken for calcareous ſulphate, but is really a mixture of this ſalt with calcareous phoſphate and lithic acid. This ſalt is of the ſame nature with the baſis of bones, and the matter of the calculus in the bladder.

When the urine has acquired the conſiſtency of clear ſyrup, it is then filtrated, and removed into a cool place. In the courſe of a certain time, it depoſites ſaline cryſtals, conſiſting of muriate of ſoda, with two peculiar ſaline ſubſtances. Theſe laſt ſalts are known by the name of *fuſible ſalts, native ſalts of urine, alkaline phoſphates, &c.*: their properties ſhall be examined in the following chapter. Several different quantities of thoſe cryſtals may be obtained, by repeated evaporation and cryſtalliſation. In theſe ſucceſſive evaporations, a certain quantity of muriate of ſoda and muriate of potaſh is cryſtalliſed. When the urine ceaſes to afford ſaline matter, it remains in the ſtate of a very thick brown fluid, a ſort of mother water, holding in ſolution two peculiar extractive ſubſtances. By evaporating this fluid to the conſiſtency of a ſoft extract, and treating the reſidue with alcohol, Rouelle the younger diſcovered, that one portion was ſoluble in alcohol, but another ſuffered no ſolution in it. The firſt of theſe matters he has called *ſaponaceous matter*; the ſecond *extractive matter*.

The ſaponaceous ſubſtance is ſomewhat ſaline, and ſuſceptible of cryſtalliſation. It is difficult to make it dry; and, even when dry, it attracts moiſture from the atmoſphere. In the retort, it affords a quantity of ammoniacal carbonate equal to more than half its weight, a little oil, and ſome ammoniacal muriate: Its reſidue gives a green tinge to ſyrup of violets.

The extractive ſubſtance, which is ſoluble in water, though not in alcohol, dries as eaſily in the water-bath as the extracts of plants: it is brown, and not ſo liable to deliquiate as the former ſalt: it affords, by diſtillation, all the uſual products of animal matters. Such, according

ing to Rouelle, are the characteriſtic and diſtinctive properties of theſe two ſubſtances which form the extract of urine. To theſe particulars we may add, that this celebrated chemiſt obtained from an ounce to an ounce and a half of extract out of a pint of urine of concoction; whereas, the ſame quantity of crude urine afforded him only one, two, or three grains.

If, inſtead of ſeparating this extract of urine into two diſtinct matters by alcohol, we diſtil it altogether by naked fire,—it affords a good deal of ammoniacal carbonate, an animal oil, and a little phoſphorus. Its coal contains a little muriate of ſoda, or common ſalt. This analyſis of urine ſhows, therefore, that the fluid conſiſts of a large proportion of water, both phoſphoric acid and lithic acid in a diſengaged ſtate, muriate of ſoda, ſulphate of lime, calcareous phoſphate, phoſphate of ſoda, and ammoniacal phoſphate, and two peculiar extractive matters which colour the fluid. With reſpect to the dark colour which it acquires in various diſeaſes, eſpecially in all caſes in which the bile is affected, I have diſcovered that it is owing to the oily matter of the bile; and that the extract of this urine, thus altered in colour, when diſſolved by alcohol, (that portion of it which is ſoluble in this menſtruum) is precipitated from it by water.

Urine, expoſed to air, is altered the ſooner, the hotter the atmoſphere. Sediments are firſt formed in it ſimply by cooling: ſeveral ſaline matters are cryſtalliſed at the ſurface, and at the bottom of the liquor; and among theſe, generally, a reddiſh ſalt, which appears to be of the ſame nature with the calculus in the bladder. Nobody has obſerved the ſpontaneous alterations of this excrementitial fluid with more attention than my colleague,

M. Hallé. In the decompoſition which urine ſuffers when left to itſelf, he has diſtinguiſhed ſeveral different periods at which ſediments or cryſtals of a different nature are found depoſited; as alſo the changes which the fluid undergoes, in conſequence of depoſiting theſe ſediments and cryſtals. We cannot enter here into a detail of theſe particuliars, relative to the changes of the fluid, and the matters which it depoſites; but the reader may find them accurately deſcribed in a valuable Memoir, inſerted among the Memoirs of the Royal Society of Medicine for the year 1779. We ſhall only mention here the principal alterations which urine ſuffers. Soon after it becomes cool, its ſmell alters, becomes more pungent and even ammoniacal; its colouring part is changed, and ſeparated from the reſt of the liquor: at length the alkaline ſmell goes off, and is ſucceeded by another, not ſo pungent, but more diſagreeable and nauſeous: at laſt the decompoſition is completely effected. Rouelle, the younger, has obſerved, that crude ſerous urine does not putrefy ſo faſt; that its colour, when it is altered, is greatly different from that of urine of concoction; and that at laſt it is covered over with mouldineſs, like the juices of vegetables, and the ſolutions of animal jelly. M. Hallé has obſerved ſome urines to become highly acid before paſſing into a ſtate of putrid decompoſition. Urine evaporated, after being ſuffered to putrefy for a year or more, affords fuſible ſalt, as well as freſh urine: but it contains much more phoſphoric acid in a naked ſtate, and effervеſces with ammoniacal carbonate: a part of its ammoniac has been volatilized by the putrefaction. When it is evaporated, the ſalt that is depoſited on the ſides of the veſſel is highly acid;

and to obtain a greater quantity of it, Rouelle, the younger, directs to add ammoniacal carbonate, till the effervescence entirely ceaſe, and the acid be completely ſaturated.

Quicklime and dry fixed alkalis inſtantaneouſly decompoſe the ſaline principles contained in urine. Nothing more is neceſſary, than to pour cauſtic potaſh or ſoda, or to caſt quicklime—into freſh urine, in order to make it yield an inſufferable putrid ammoniacal ſmell. It is by decompoſing the ammoniacal phoſphate, that theſe ſubſtances produce ſuch a ſmell. M. Berthollet has diſcovered, that lime-water produces, in freſh urine, a precipitate from which phoſphorus may be obtained. This phenomenon is occaſioned by the union of the lime-water with the exceſs of phoſphoric acid: And the precipitate is formed, 1. Of the calcareous phoſphate that naturally exiſts in urine, and was maintained in ſolution only in conſequence of there being an exceſs of phoſphoric acid; 2. Of new calcareous phoſphate, formed by the union of the lime that has been added with the acid that was before in a ſtate of freedom. M. Berthollet having obſerved, that cauſtic ammoniac likewiſe precipitates calcareous phoſphate from urine, by neutralizing the naked phoſphoric acid by which that ſalt was held in ſolution, remarks, that the weight of this precipitate, compared with that which is produced by lime-water, indicates the quantity of naked phoſphoric acid contained in the urine; for, in fact, the ammoniacal phoſphate formed on this occaſion remains diſſolved in the fluid, whereas the calcareous phoſphate produced by lime-water is precipitated, as inſoluble, at the ſame time with the calcareous phoſphate naturally exiſting in the urine.

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The acids produce no effects on freſh urine: but they ſpeedily deprive putrid urine of its ſmell; and they, in the ſame manner, deſtroy the ſmell of the ſediments which it depoſites in that ſtate. Urine when heated, inſtantly diſſolves the ſediment that had taken place in conſequence of its cooling.

Urine decompoſes many ſolutions of metals. Lemery has made known, under the name of *the roſe-coloured precipitate*, a magma, of a roſe colour, that is formed by pouring the nitric ſolution of mercury into urine. That precipitate is formed partly by the muriatic acid, and partly by the phoſphoric acid contained in the fluid. M. Brongniart has obſerved, that ſometimes this preparation takes fire by friction, and that it burns with rapidity on burning coals,—phenomena which he aſcribes to its containing a ſmall portion of phoſphorus.

Such is the ſtate of our preſent knowledge concerning the chemical properties of urine. Much yet remains to be done, before we can obtain all the information concerning this matter that analyſis is capable of furniſhing. The ſeveral ſediments that have been obſerved in urine, and ſo accurately diſtinguiſhed by M. Hallé, ſhould be analyſed: The red or tranſparent ſaline concretions that are formed in it, and have been taken by Scheele for lithic acid, ſhould alſo be analyſed; and in like manner, the copious ſediment which urine affords after fits of the gout, from perſons afflicted with ſtone, &c.

We ſhall, however, in the following chapter, examine the ſeveral ſaline products that urine affords, with the properties of which phyſicians ought to make themſelves well acquainted.

CHAP. IX.

Of the Ammoniacal Phoſphate, the Phoſphate of Soda, and the Stone in the Bladder, or the Lithic Acid.

WE have ſeen, that urine contains certain peculiar ſalts. Thoſe are combinations of phoſphoric acid with ammoniac, ſoda, lime, and the acid baſe of the ſtone in the bladder. Continuing to uſe, for theſe ſubſtances, the methodical denominations already mentioned, we ſhall ſucceſſively examine the ammoniacal phoſphate, the phoſphate of ſoda, and the lithic acid. As to the calcareous phoſphate, we ſhall deſcribe its properties under the article *Bones*.

The ſalt obtained from evaporated urine by cooling and reſt, has been called in general *fuſible ſalt;* becauſe, as we ſhall immediately ſee, it melts in the fire: it has been alſo called *eſſential ſalt of urine*, *microcoſmic ſalt.* In this primary ſtate, it is a mixture of ammoniacal phoſphate, of muriate, and of phoſphate of ſoda, contaminated with an extractive matter. Several chemiſts, particularly Margraf, have been of opinion, that, to avoid the mixture of marine ſalt, the urine muſt be ſuffered to putrefy; and the marine ſalt is, by the putrefaction of the urine, changed into phoſphate. That opinion has been ſince proved to be falſe: 120 pints of freſh urine afford, according to Margraf, about four ounces of ammoniacal phoſphate, and two ounces of phoſphate of ſoda.

It is not eaſy to effect an entire ſeparation of theſe ſubſtances of which the ſoluble ſalt conſiſts, that is obtained by a firſt cryſtalliſation, and was conſidered by Schockwitz, Le Mort, Boerhaave, Henckel, and Schloſſer, as a ſingle ſalt. To accompliſh this ſeparation, it has been recommended to diſſolve the ſalt in hot water, to evaporate, and cryſtalliſe it. But Rouelle the younger, and the Duke of Chaulnes, are the only chemiſts that have mentioned a very great and uncommon difficulty with which the proceſs is attended: Moſt of the ſalt is carried off by the heat of the ſolution and evaporation, and about three fourths of it are loſt. The Duke of Chaulnes has given a proceſs for purifying it with as little loſs as poſſible: which conſiſts in filtrating the ſolution, and leaving it to cool in cloſe-ſtopped veſſels. By either of theſe manipulations, there is obtained, firſt, a ſalt cryſtalliſed in rhomboidal tetrahædral priſms; very much compreſſed, which has been conſidered as pure ammoniacal phoſphate; and, above theſe firſt cryſtals, another ſalt, in cubes, or rather oblong ſquare tables, very different from the former ſalt in ſhape; this again has been taken for phoſphate of ſoda. This laſt ſalt, as has been remarked by Rouelle the younger, may alſo be ſeparated, by taking off the efflorescence that gathers on the former ſalt, which is liable to no ſuch alteration. But each of theſe ſalts is a treble ſalt; the firſt is formed of a large proportion of ammoniacal phoſphate, and a little phoſphate of ſoda: in the ſecond the order of compoſition is inverted.

Of Phoſphate of Ammoniac and Soda[*].

I DISTINGUISH by this name the ſalt that cryſtalliſes firſt pure, which has been taken for phoſphate of ammoniac purified and cryſtalliſed firſt during the purification of the fuſible ſalt. It is in the form of rhomboidal tetrahædral priſms, much compreſſed, and generally truncated in their length, and at the angles: in conſequence of theſe circumſtances, the priſms are, in ſome meaſure, hexagonal. There are likewiſe often enough found, according to M. Romé de Lille, from whom I take my deſcription of this ſalt, longitudinal ſegments of the priſms, of which ſegments the ſide that lies on the capſule is the broadeſt; it is alſo rhomboidal, and interſected by two diagonal lines, croſſing at the middle. The tetrahædral or octahædral form aſcribed to it, appears only while this ſalt yet retains muriate and phoſphate of ſoda. The power of communicating the octahædral form ſeems to belong peculiarly to the muriate of ſoda; for, when the former ſalt is diſſolved in urine, and the liquor expoſed to the ſun, regular octahædral cryſtals are obtained in the courſe of a few days. The taſte of phoſphate of ammoniac and of ſoda is at firſt freſh, and afterwards urinous, bitter, and pungent: When heated with the blow-pipe on a burning coal, it ſwells, diffuſes a ſmell of ammoniac, and melts, into a deliqueſcent vitreous globule: When diſtilled in a retort, the heat diſengages from it ſome very pungent and cauſtic ammoniac: the reſidue is a very fixed and fuſible tranſparent glaſs, which corrodes the retort. Margraff ſays, that it is ſoluble in two or three parts of diſtilled water, and exhibits the properties of an acid. Rouelle affirms it to be a deliqueſcent. M. de Morveau, again, thinks, that with the help of a good fire, it may be reduced into an unalterable vitreous ſtate. M. Prouſt has diſcovered, that this vitreous reſidue is a combination of phoſphoric acid with a peculiar matter which he does not ſeem to have known, and which is nothing but phoſphate of ſoda, as appears from the reſearches of ſeveral modern chemiſts. But it is to be obſerved, that this glaſs, which ſtill retains a portion of phoſphate of ſoda, is always opaque, or exceedingly liable to become ſo: it is only the pure artificial ammoniacal phoſphate that a affords a very tranſparent glaſs, like the phoſphoric acid alone.

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[*] In a methodical nomenclature of triple ſalts, the place of the words which deſign their baſes ought to indicate their reciprocal proportions: the firſt named baſe is the moſt abundant. F.

Phoſphate of ammoniac and of ſoda is not liable to be altered by the action of air.

It appears to be very ſoluble in water, only five or ſix parts of cold water being requiſite to maintain it in ſolution. Hot water, at the temperature of 170 degrees, decompoſes it, and even volatilizes a part of its acid.

Phoſphate of ammoniac and of ſoda acts as a flux on ſiliceous earth, aluminous earth, barytes, magneſia, and lime: But theſe vitreous compounds are owing to the phoſphoric acid, and to the phoſphate of ſoda; for the ammoniac is diſengaged before the fuſion takes place.

Lime, and the two fixed alkalis, in a pure ſtate, decompoſe ammoniacal phoſphate, and ſeparate the ammoniac. Lime-water, poured into a ſolution of this ſalt, produces a white precipitate, which can be nothing but calcareous phoſphate. Alkaline and earthy carbonates likewiſe decompoſe it, and ſeparate the ammoniac in the ſtate of ammoniacal carbonate.

The effects of the mineral and vegetable acids on phoſphate of ammoniac and ſoda, have not as yet been examined with ſufficient care. It muſt depend on the various elective attractions which exiſt between the phoſphoric acid and its alkaline baſes. We ſhall treat of it when we come to treat of that acid.

The ſame is the caſe with reſpect to the alterations which phoſphate of ammoniac and of ſoda ſuffers from metals, and metallic oxides; for thoſe alterations depend entirely on the phoſphoric acid.

Phoſphate of ammoniac and of ſoda, treated with coal, affords phoſphorus. Bergman propoſes the uſe of it as a flux, in aſſays with the blow-pipe.

Of Phoſphate of Soda and Ammoniac.

We have deſcribed the manner in which phoſphate of ſoda and ammoniac is obtained. It was conſidered at firſt as a pure phoſphate of ſoda, but always contains a little phoſphate of ammoniac. It will be proper to give the dates of the different diſcoveries concerning it, before we proceed to examine its properties.

Hellot, in the year 1737, ſeems to have been the firſt who mentioned it; but he took it to be ſulphate of lime. Haupt, in the year 1740, gave a better account of it, under the name of *ſal mirabile perlatum*. Margraf dedeſcribed it in the year 1745. Pott made mention of of it in the year 1757, but, like Hellot, took it for ſulphate

phate of lime. Rouelle, the younger, examined it in the year 1776, and gave it the name of *fuſible ſalt, with a baſe of natrum.* All theſe chemiſts perceived this ſalt to be different from the laſt, chiefly by obſerving, that it did not afford phoſphorus with coal. But Rouelle has diſtinguiſhed its properties better than any of the reſt. According to him, its cryſtals are flat, irregular, tetrahædral priſms, with one of the extremities dihædral, and conſiſting of two rhomboids, the other adhering to the baſe. The four ſides of the ſolid are two alternate irregular pentagons, and two oblong rhomboids, cut ſlope-wiſe.

Phoſphate of ſoda and ammoniac expoſed to heat in a crucible, melts, and affords a white, opaque maſs. When heated in a retort, it affords nothing but phlegm, without any acid or alkaline character; and the reſidue is an opaque glaſs, or frit.

In the air, this ſalt effloreſces, and falls all down into duſt.

It diſſolves readily in diſtilled water, and cryſtalliſes by evaporation: the ſolution turns the ſyrup of violets green.

Calcareous nitrate decompoſes it: a precipitate of calcareous phoſphate is formed; and the ſupernatant liquor affords nitrate of ſoda.

This ſalt is equally liable to be decompoſed by the nitric ſolution of mercury. It forms a white precipitate, which, when diſtilled in a retort, affords a little reddiſh ſublimate, and ſome running mercury, and leaves in the bottom of the retort, an opaque white maſs, adhering to, and combined with the glaſs. This mercurial precipitate forms again phoſphate of ſoda, when boiled with a ſolution of carbonate of ſoda, and leaves the mercury in the ſtate of a brick-red powder. Such are the facts which the younger M. Rouelle diſcovered concerning this ſalt. M. Prouſt, being engaged by that celebrated chemiſt, whoſe pupil he was, in a new examination of this matter, made a great many experiments upon it; of which the following are the principal reſults. On lixiviating the reſidue of phoſphorus, formed from fuſible ſalt of the firſt cryſtalliſation, from which he had obtained no more phoſphorus but what was equal to an eighth part of the weight of the ſalt; the lixivium afforded, by evaporation in the open air, parallelogrammatic cryſtals, an inch in length, and in the proportion of five or ſix drachms to the ounce of the fuſible ſalt from which the phoſphorus was formed. It is to be obſerved, that this proportion would not be ſo great, were it not for the water that enters into the cryſtals. This ſubſtance melts in the fire into an opaque glaſs: it communicates a green colour to flame: it effloreſces in the air: it decompoſes nitrates and muriates, by diſengaging the acids: it forms glaſſes with earthy matters, by fuſion: it ſaturates alkalis, like an acid. From theſe facts M. Prouſt concluded this ſaline ſubſtance to be different in nature from all that he was before acquainted with,—to be combined with phoſphoric acid, and ammoniac in ammoniacal phoſphate,—and to form, with ſoda, Rouelle's *fuſible ſalt with a baſe of natrum.* He obſerved, that it performed the functions of an acid, and compared it to the boracic acid. On this idea, M. Prouſt made new experiments on the fuſible ſalt with a baſe of natrum, obtained by Rouelle's proceſs, above deſcribed.

According to him, lime decompoſes this ſalt; having a greater affinity than ſoda with the peculiar ſubſtance which performs in it the functions of an acid. Lime-water poured into a ſolution of this ſalt, produces a precipitate; and the ſoda is left in ſolution, in a pure cauſtic ſtate.

The mineral acids, and even diſtilled vinegar, decompoſe it, in a way directly contrary to this. Rouelle ſuppoſed, that the ſulphuric and the nitric acids did not act on this ſalt, becauſe they produced upon it no viſible change; but M. Prouſt, on mixing the ſulphuric, the nitric, the muriatic, and the acetous acids, with a ſolution of *fuſible ſalt with a baſe of natrum*, obſerved, that although there was no precipitate formed in theſe mixtures, yet the liquors, when evaporated and cooled, afforded ſulphate and nitrate, muriate and acetite of ſoda: which proves, 1. That the ſalt has been decompoſed by theſe acids: 2. That it contains ſoda, as had been before ſhewn by the younger Rouelle. As to the ſeparate ſubſtance which was before in union with the ſoda, it is plain that it remains in ſolution in the liquors, together with the new neutral ſalts. M. Prouſt diſtinguiſhed it very plainly in the mother-water, obtained after the mixture of vinegar with the ſolution of the fuſible ſalt, and the cryſtalliſation of the acetite of ſoda. By pouring on that mother-water, eight or ten times its bulk of alcohol, the laſt portions of the neutral acetous ſalt are diſſolved, and a magma is formed, which muſt be waſhed with a new quantity of alcohol, and then diſſolved in diſtilled water. This ſolution of the magma, when evaporated in the open air, affords parallelogrammatic cryſtals, preciſely like thoſe which are obtained by waſhing the reſidue of phoſphorus, formed from fuſible ſalt of the firſt cryſtalliſation, from urine. It is therefore, according to M. Prouſt, a peculiar ſubſtance, of the ſame nature with the boracic acid, which ſaturates the ſoda, in fuſible ſalt with a baſe of natrum. This diſcovery ſeems to explain the reaſon why this ſalt does not afford phoſphorus. To theſe particulars M. Prouſt added, that it was a new ſubſtance, which exiſted always in true fuſible ſalt, or phoſphate of ſoda and of ammoniac, and communicated to the phoſphoric acid the property of melting into a glaſs; and for this reaſon, I gave it, in the firſt edition of this work, the name of *the baſe of phoſphoric glaſs*. But M. Morveau has ſince been convinced, on ſufficient evidence, that the pure phoſphoric acid, obtained from phoſphorus by deliqueſcence, and conſequently containing none of that ſubſtance, is fuſible, by heat alone, into a ſolid and permanent glaſs. This ſeries of experiments which M. Prouſt made with great care, and of which the reſults are particularly ſtriking, induced Bergman to conſider this ſubſtance as a peculiar acid: He gives a hiſtory of it in the ſecond edition of his Diſſertation on Elective Attractions, under the name of *acidum perlatum*, derived, no doubt, from the denomination given by M. Haupt, in the year 1740, to fuſible ſalt with a baſe of natrum. M. de Morveau has introduced it, as a diſtinct article, into his Chemical Dictionary, under the name of the *ouretic acid*, from the Greek name of urine, which affords it. But, ſince M. Prouſt's experiments, Bergman's Diſſertation, and the compilation of M. de Morveau's article, M. Klaproth has publiſhed, in M. Crell's Journal, an analyſis of *fuſible ſalt with a baſe of natrum*; which annihilates this pretended peculiar acid, and ſhews it to be nothing but phoſphoric acid in combination with ſoda. Mr Klaproth diſcovered this truth by ſuch another experiment as that of the younger Rouelle. On precipitating the ſolution of *fuſible ſalt with a baſe of natrum*, by calcareous muriate or nitrate; the precipitate, which Rouelle had before mentioned as analogous to the baſe of bones, actually affords phoſphoric acid by means of ſulphuric acid. Mr Klaproth adds, that, on ſaturating phoſphoric acid, obtained by the ſlow combuſtion of phoſphorus with ſoda, with a ſmall exceſs of the ſoda, there is a ſalt formed, preciſely of the ſame nature with Haupt's *ſal perlatum*, or Rouelle's *fuſible ſalt with a baſe of natrum*; and that, in order to obtain the ſubſtance deſcribed by M. Prouſt, nothing more is neceſſary but to deprive this neutral ſalt of its exceſs of ſoda, by vinegar, or to add to it a little phoſphoric acid. After this, we need not be ſurpriſed to find Bergman repreſenting the affinities of the *acidum perlatum*, as preciſely the ſame with thoſe of the phoſphoric acid. This detail of particulars has been given by M. de Morveau, in a ſupplement to the acids of the mineral kingdom; and he grants, that after this, the *ouretic* acid, and *ouretic* ſalts, are no more to be mentioned. In addition to all theſe details, we have only to add further, in order to render the hiſtory of this ſalt complete, that phoſphate of ſoda always contains a little phoſphate of ammoniac, and that this laſt ſalt acts a part in all the combinations into which it enters.

It is very extraordinary, that phoſphate of ſoda is not decompoſable by carbone, like ammoniacal phoſphate; —that carbone cannot deprive the phoſphoric acid, when in union with ſoda, of its oxigene. This baſe, therefore, renders this acid incapable of being decompoſed by coal; although it does not act in the ſame way on the ſulphuric, and various other acids. This is a ſtriking exception from the general law of the attractive elections of oxigene, of which no other inſtance is yet known. It is not leſs remarkable, that an exceſs of phoſphoric acid, added to phoſphate of ſoda, gives to this compound, which, according to Mr Klaproth, is the peculiar ſubſtance of M. Prouſt, the power of rendering ſyrup of violets green.

M. de Morveau adds to the hiſtory of phoſphate of ſoda, that a ſolution of muriate of lead poured into a ſolution of this ſalt, produces a precipitate of phoſphate of lead. This laſt ſalt, by diſtillation with carbone, affords phoſphorus; as M. de Laumont, inſpector of the mines, has diſcovered with an ore from the mines of Huelgoet. From this it appears, in what manner corneous lead, the uſe of which, in the diſtillation of phoſphorus of urine, has been propoſed by Margraf, may augment the quantity of the product, as we ſhall explain in the following chapter.

Of the Lithic Acid.

The calculus or ſtone that is formed in the human bladder, has long engaged the attention of chemiſts and phyſicians. Paracelſus, who gave it the barbarous name of *duelech*, imagined it to conſiſt of an animal reſin, and compared it to arthritic concretions. Van Helmont thought it a concretion formed of the ſalts of urine, and an earthy volatile ſpirit; and believed it to be of a very different nature from arthritic chalk, the formation of which was, in his opinion, owing to the thickening and acidification of the ſynovia. Boyle extracted from it, oil, with a good deal of volatile ſalt. Boerhaave admitted in it the exiſtence of an earth in union with volatile alkali. Hales extracted from it 645 times its own bulk of air; and out of 230 grains, obtained no more than 49 grains of reſidue: He called it *animal tartar.* Many learned phyſicians, and eſpecially Whyte and Deſten, have conſidered alkaline matters as the true ſolvent of the urinary calculus. Several even propoſed the uſe of the ſoap-makers' lixivium for that purpoſe. But none of theſe notions was founded on an exact analyſis of the calculus. Scheele and Bergman firſt undertook ſuch an analyſis.

The former of theſe chemiſts diſcovered, that the ſtone in the bladder conſiſts moſtly of a peculiar acid, to which we give the name of the *lithic acid.* 70 grains of the calculus in the bladder afforded him, by diſtillation, 28 grains of this acid, in a dry and ſublimated ſtate,—ſome ammoniacal carbonate, and 12 grains of coal, which he found it very difficult to reduce to aſhes. 1000 grains of boiling water diſſolved 396 grains of the ſame acid: This lixivium reddened blue colours; but the greateſt part ſeparated in ſmall cryſtals by cooling.

Concentrated ſulphuric acid diſſolves the calculus, with the help of heat; and paſſes, in conſequence of effecting this ſolution, into the ſtate of concentrated ſulphureous acid. The muriatic acid does not act upon it; the nitric diſſolves it entirely: nitrous gas and carbonic acid are diſengaged, while this laſt ſolution is taking place. This ſolution is red; it contains a naked acid; it communicates a red tincture to the ſkin, and all organic tiſſues: When tried with ſoluble barytic ſalts, it exhibits no mark of its containing ſulphuric acid,—nor of lime, when tried with oxalic acid. Lime-water forms in it a precipitate, which diſſolves, without effervefcing, in acids. Cauſtic alkalis, according to Scheele, diſſolve the calculus: theſe ſolutions are precipitated by lime; 1000 grains of lime-water diſſolve 537 of any of theſe precipitates; and ammoniac, in a large proportion, acts in the ſame manner on the calculus. That celebrated chemiſt aſſerts, that the brick-coloured ſediment in the urine of people in a fever, is of the ſame nature. Although Scheele found no lime in the ſtone of the bladder, yet Bergman obtained ſome from it, by precipitating the nitric ſolution with ſulphuric acid, and calcining the reſidue of the ſame ſolution. Bergman likewiſe diſcovered in the calculus, a white ſpongy matter, inſoluble in water, acids, or alkalis: The incinerated coal of this ſubſtance, of which the quantity was ſo ſmall that he could not aſcertain its nature, is not even ſoluble in nitric acid.

From this analyſis by two ſuch celebrated philoſophers, which has been again and again repeated by different chemiſts, the ſtone in the bladder appears to be of a different nature from the earth of bones. Yet Mr Tennant, Fellow of the Royal Society of London, has found in the bladder, ſtones which loſt only two thirds by calcination, and whoſe reſidue melted into an opaque glaſs by cooling. Theſe muſt therefore have contained a pretty conſiderable quantity of calcareous phoſphate.

As to the lithic acid,—the properties which it is known to poſſeſs, are, 1. That of being concrete and cryſtalline: 2. That of being almoſt inſoluble in water, but more ſoluble in hot than in cold water: 3. That of being ſoluble in nitric acid, from which it abſorbs oxigene, and forming, after this ſolution, a deliqueſcent red maſs, which communicates a colour to many bodies: 4. That of combining with earths, and metallic oxides; and forming with them peculiar neutral ſalts, which we call *ammoniacal lithiate*, *lithiate of copper*, *calcareous lithiate*, *lithiate of potaſh*, *lithiate of ſoda*, &c. 5. The property of preferring, in its attractions, alkalis to earths: 6. Laſtly, that of yielding theſe baſes to the weaker of the other acids, even to the carbonic acid, which renders the calculus inſoluble by alkaline carbonates; this laſt property is peculiar to this acid. But, as M. de Morveau has very well obſerved, much remains to be done before we can obtain a ſufficient knowledge of the lithic acid; and, I may add, even before we can determine whether it be not a modification of ſome other acid; which may be ſuſpected from what we know concerning the relations of the vegetable acids to one another, and the identity of the pretended *acidum perlatum* and *ouretic acid*, with the phoſphoric acid.

M. de Morveau thinks the concretions at the joints, which phyſicians have conſidered as of the ſame nature with the calculus of the bladder, to be, in their nature, very different from it. But his opinion is founded only on ſome experiments of Schenckius, Pinelli, and Whyte, which were far from being performed with due accuracy and attention: And the obſervations of Boerhaave, Frederic Hoffman, Springsfield, Alſton, Leger, &c. concerning the good effects of alkaline waters, ſoap, and lime-water, in arthritic and calculous caſes, have, with me, greater weight in eſtabliſhing the analogy between theſe two ſorts of concretions, than the others in deſtroying it. There is, however, no refuſing to agree with M. de Morveau, that experiments only can determine the queſtion. This is a new proof of the beneficial influence of chemical reſearches on the ſcience of medicine, and the advantages which it may derive from them *.

CHAP.

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* It is related by M. Ræring, in the Memoirs of the Academy of Stockholm, for the year 1783; that the concretions expectorated by an old man ſubject to the gout, were found to be of the nature of bone or phoſphate of lime.

In the firſt volume of the Medical Communications of London, *Anno* 1784, Dr Watſon relates, that arthritic concretions were found to be ſoluble in the ſynovia, and to mix eaſily with oil and water; properties not belonging to the calculus—H.

CHAP. X.

Of Kunckel's Phoſphorus.

PHOSPHORUS is one of the moſt combuſtible ſubſtances known. As it was firſt extracted from urine, and as the matter which affords the moſt of it, is ammoniacal phoſphate, it ſeems therefore moſt ſuitable to give the hiſtory of this inflammable ſubſtance in this place.

The diſcovery of phoſphorus is owing, according to Leibnitz, to an alchemiſt of the name of Brandt, a citizen of Hamburgh, who found it out in the year 1667. Kunckel, to gain the knowledge of the proceſs, aſſociated with a man of the name of Krafft: But Krafft not communicating to him the ſecret, Kunckel reſolved to ſearch for it himſelf; and after many experiments on urine, from which he knew it to obtained, he at laſt produced phoſphorus, and was conſidered as being truly the diſcoverer of it. Some alſo aſcribe the honour of this diſcovery to Boyle, who, in the year 1680, actually gave a ſmall quantity of it into the hands of the Secretary to the Royal Society of London. But Stahl aſſerts, that Krafft had told him, that he communicated his proceſs for making phoſphorus to Boyle. Boyle communicated his proceſs to a German, whoſe name was Godfreid Hankwitz, who had an excellent laboratory at London, and was the only man that prepared phoſphorus, and ſold it, through all Europe. Although, between the year 1680, and the beginning of the preſent century, there were produced many receipts for making phoſphorus, and, among others, Boyle's, Krafft's, Brandt's, Homberg's, Teichmeyer's, Frederic Hoffman's Niewentyt's, and Wedelius's; yet no chemiſt had hitherto prepared it openly; and the preparation was ſtill quite a ſecret, when, in the year 1737, a foreigner offered to communicate, at Paris, an infallible proceſs for making phoſphorus. The Academy named four chemiſts, Meſſrs Hellot, Dufay, Geoffroy, and Du Hamel, to try the proceſs in the laboratory in the King's garden. The proceſs ſucceeded. The miniſter beſtowed a reward on the diſcoverer; and Hellot gave an accurate account of the proceſs, in a Memoir, inſerted among the Memoirs of the Academy for the year 1737. This proceſs conſiſts in evaporating five or ſix hogſheads of urine, till it be reduced to a granulated, hard, black, gliſtering matter,—calcining the reſidue in an iron pot, red-hot in the bottom, till ſuch time as it ceaſe to ſmoke, and take the ſmell of peach-flowers,—lixiviating this matter with, at leaſt, twice as much hot water,—and drying it, after decanting off the water. Three pounds of this matter muſt be mixed with a pound and an half of coarſe ſand, or pounded ſtoneware, and four or five ounces of powder of charcoal of beech. This mixture is to be moiſtened with half a pound of water, and introduced into an Heſſian retort. The matter is aſſayed, by making a portion of it red-hot in a crucible: If it exhibit a violet flame, and diffuſe a ſmell of garlic, it will afford phoſphorus. The retort is placed in a furnace made on purpoſe; and a large balloon, about one third of which muſt be filled with water, adapted to it. The balloon muſt be perforated with a ſmall hole; and Hellot conſidered this as one of the manipulations that are the moſt neceſſary for the ſucceſs of the operation. Three or four days after the apparatus has been ſet up, a moderate fire is kindled under it, to dry the furnace and the lutings: by degrees, the fire is augmented, and it is kept for fifteen or twenty hours in this ſtate. The phoſphorus does not diſtil till fourteen hours after the beginning of the operation, which laſts, in all, twenty-four hours. There ariſes, firſt, a large quantity of ammoniacal carbonate, a part of which is diſſolved by the water in the balloon. Volatile or aëriform phoſphorus paſſes, next, in luminous vapours: the true phoſphorus then runs, like an oil, or melted wax. When it ceaſes to paſs, the apparatus muſt be left to cool for two days. The luting muſt then be taken off; and water added, to looſen the phoſphorus adhering to the ſides of the receiver: It is now melted in boiling water; for which purpoſe, it is cut into ſmall pieces, which are introduced into the necks of matraſſes, cut towards the middle of the body into the form of a funnel, and immerſed in boiling water. The phoſphorus melts, is purified, and rendered tranſparent by the ſeparation of a blackiſh matter which riſes above it. It is then put into cold water, where it congeals; and it is now thruſt out of the matraſſes with a ſmall ſtick.—Such, in ſhort, is the proceſs deſcribed by Hellot. The tedioufneſs of the operation hindered it from being repeated by any chemiſts but

Rouelle, the elder, who, in his courſes of chemiſtry, went through it ſeveral times with ſucceſs.

In the year 1743, Margraf publiſhed, in the Memoirs of the Academy of Berlin, a new method for making, at once, a pretty large quantity of phoſphorus, eaſier than had been done before him. In this proceſs, the corneous lead which remains from the diſtillation of four pounds of *minium*, and two pounds of ammoniacal muriate, is mixed with ten pounds of extract of urine, of the conſiſtency of honey. A pound and a half of powder of charcoal is next to be added to it. The mixture muſt be dried in an iron pot, till it be converted into a black powder. This powder is to be diſtilled in a retort, in order to extract from it, by a graduated fire, the ammoniacal carbonate, the fœtid oil, and the ammoniacal muriate which it contains. Care muſt be taken, however, to urge it with fire no farther than juſt to make the retort red-hot. The black friable reſidue of this diſtillation, is the matter from which the phoſphorus is extracted. It is aſſayed, by caſting a little of it on burning coals. If it diffuſe a ſmell of garlic, and a blue phoſphoric flame, it may then be conſidered as well prepared. A retort of Heſſian or Picardy earth is filled three-fourths full of it, and well luted. This veſſel is then placed in a reverberating furnace, with a dome, and an iron chimney, ſix or eight feet high. A middle-ſized receiver, perforated with a ſmall hole, and half-full of water, is fitted to the retort. The joinings muſt be luted with fat-lute, and covered with fillets of cloth dipped in white of eggs, and lime: A brick-wall muſt be raiſed between the furnace and the receiver; and after this apparatus has been ſuffered to dry for a day or two, the diſtillation may be carried on by a properly graduated fire. This operation laſts from ſix to nine hours, according to the quantity of the matter to be diſtilled. The phoſphorus, thus obtained, is rectified by diſtilling it by a very moderate fire, in a glaſs retort, with a receiver half-full of water. Almoſt all chemiſts have repeated Margraf's proceſs ſucceſsfully: and it was the only one in uſe, till, within theſe few years, another was diſcovered, which conſiſts in ſeparating the phoſphoric acid from bones; as we ſhall mention when we come to ſpeak of ſolid bodies.

It appears that the only thing in which Margraf's proceſs differs from Hellot's, is in the addition of the muriate of lead, and the diviſion of the operation into two. But what is of moſt importance in the ingenious chemiſt of Berlin's proceſs, is, that it determines the nature of the ſubſtance contained in urine, which ſerves for the formation of phoſphorus. By diſtilling a mixture of *fuſible ſalt* with charcoal, he obtained excellent phoſphorus; and he obſerves that the urine from which he had extracted that ſalt would yield no more of this combuſtible ſubſtance. That ſubſtance, therefore, which contributes to the formation of phoſphorus, muſt be a conſtituent part of fuſible ſalt; and indeed phoſphorus is eaſily obtained by diſtilling two parts of glaſs obtained from the decompoſition of fuſible ſalt in a retort or crucible, with one part of powdered charcoal. This operation requires much leſs time, and much leſs fire, than any we have yet deſcribed; for, according to M. Prouſt, the phoſphorus is ready to run in quarter of an hour. This, doubtleſs, is the beſt proceſs that can be uſed to obtain phoſphorus of urine. But there are ſeveral obſervations to be made on this head: 1. The vitreous reſidue, remaining after the decompoſition of ammoniacal muriate by fire, not being pure phoſphoric acid, but phoſphoric acid in combination with phoſphate of ſoda, which is not decompoſable by coal, only a very little phoſphorus can, therefore, be obtained by employing this reſidue,—an ounce of it affording no more than a drachm, and often leſs: 2. When fuſible ſalt is prepared in any large quantity by evaporation and cooling, it is found to be mixed with a conſiderable proportion of phoſphate of ſoda, which affords no phoſphorus. Theſe two obſervations may be, therefore, conſidered as explaining, why ſo little of this combuſtible body is obtained by the diſtillation of fuſible ſalt with coal. Perhaps, fuſible ſalt in its original ſtate, or the mixture of ammoniacal phoſphate with phoſphate of ſoda, if diſtilled with coal and muriate of lead, would afford more phoſphorus; for muriate of lead appears to be capable of decompoſing phoſphate of ſoda.

Phoſphorus, by whatever of theſe proceſſes obtained, is ſtill the ſame. When very pure, it is tranſparent, and its conſiſtency like that of wax. Its cryſtalliſes by cooling, into brilliant plates of a micaceous appearance. In hot water, it melts a conſiderable time before the fluid be heated to ebullition. It is highly volatile, and riſes in a thick fluid by a moderate heat. In contact with air, it exhales a thick ſmoke from every part of its ſurface: this vapour diffuſes a ſtrong ſmell of garlic, and appears white in day-light, and in the dark very luminous. It is a ſlow inflammation of the phoſphorus from which it proceeds; and when left for any time expoſed to the air, phoſphorus is gradually conſumed, and leaves as a reſidue a peculiar acid, the properties of which we

will

will afterwards examine. This ſlow combuſtion never takes place but when the phoſphorus is in contact with air: Nay, to render it very luminous, a heat from twelve to fifteen degrees of Reamur's thermometer, or about ſixty-three degrees of Fahrenheit's, is requiſite; although the inflammation may take place under that temperature. This inflammation is not accompanied with heat, nor does it kindle any other combuſtible body. But when phoſphorus is expoſed to a dry heat of 24 degrees Reaumur, or 86° Fahrenheit, it kindles with decrepitation: it burns rapidly with a very lively white flame, mixed with yellow and green, and deſtroys very ſpeedily any combuſtible body that comes within its influence. The vapours which then exhale from it are very copious, white, and very luminous in the dark. This rapid combuſtion takes place with a very ſtrong heat, and a very ſparkling light, in a receiver full of vital air.

In theſe two different ſorts of combuſtion, phoſphorus leaves different reſidues. The firſt affords a liquor weighing more than twice as much as the phoſphorus employed on the occaſion, which we call the *phoſphorous acid.* The ſecond gives a very deliqueſcent and ſoluble white, concrete matter, which is the *phoſphoric acid.* This laſt was thought to reſemble the acid and fluid reſidue of the firſt combuſtion, or the ſlow inflammation. But the two acids exhibit real differences in their combinations, as was firſt obſerved by Margraf, and has been ſhewn by M. Sage, in the Memoirs of the Academy for the year 1777. We will ſpeak more particularly of theſe differences in the hiſtory of the two acids.

The combuſtion of phoſphorus was conſidered by Stah

Stahl as the diſengagement of the phlogiſton which he thought to be combined with muriatic acid * in that combuſtible body. M. Lavoiſier, in order to diſtinguiſh what happens in this combuſtion, kindled, with a red-hot iron, a quantity of phoſphorus in a bell-glaſs immerſed in mercury. He obſerved, that no more than a given quantity of this matter can be burnt in a certain bulk of air; that the quantity amounts to one grain of phoſporus to ſixteen or eighteen cubic inches of air; that, after this combuſtion, the phoſphorus is extinguiſhed, and the air rendered unfit to contribute to the combuſtion of a new quantity of phoſphorus; that the bulk of the air is diminiſhed, and the phoſphorus converted into white, ſnowy flakes, which fix on the ſides of the bell-glaſs: Thoſe flakes are equal to twice and one half more, the weight of the phoſphorus from which they are formed; and this increaſe of the weight of the phoſphorus correſponds exactly to the diminution of weight which the air has ſuffered, and is owing ſolely to the abſorption of phoſphorus by the oxigene. In fact, the white flakes are concrete phoſphoric acid, produced by the combination of phoſphorus with the oxigene, or baſe of vital air, contained in the atmoſpheric air which has contributed to the combuſtion of that inflammable ſubſtance. The theory of this ſubſtance is the ſame with that

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* Stahl, in ſeveral of his works, has aſſerted, that phoſphorus may be compoſed by combining muriatic acid with phlogiſton. Margraf engaged in a ſeries of experiments with a view to this; in which he treated various combinations of the muriatic acid with combuſtible matters; but could never ſucceed. He has even ſhewn, in a ſatisfactory manner, that the acid formed by the burning of this combuſtible body, is very different from that of marine ſalt; and all chemiſts are now of the ſame opinion.—F.

that of ſulphur; and it is therefore unnceſſary to make any addition here to what was ſaid on that head, in the mineral kingdom. We ſhall only obſerve, that of all combuſtible bodies, phoſphorus ſeems to diſengage the greateſt quantity of caloric and light from vital air, and that it abſorbs the oxygen in the moſt ſolid ſtate.

Phoſphorus becomes liquid in hot water. Vital air, paſſed through phoſphorus thus liquefied in water, burns it, and reduces it into the ſtate of phoſphoric acid.

Phoſphorus, though not ſoluble in this fluid, yet ſuffers, by degrees, an alteration in it. It loſes its tranſparency, becomes yellow, and is covered over with an efflореſcence, or coloured duſt. The water becomes acid, and appears luminous when ſhaken in the dark. The phoſphorus is then ſlowly decompoſed.

Cauſtic fixed alkalis diſſolve phoſphorus, with the help of a boiling heat. While this combination takes place, there is a fœtid gas diſengaged that was firſt diſcovered by M. Gingembre, and poſſeſſes the ſingular property of kindling with an exploſion, when brought into contact with atmoſpheric air, and more inſtantaneouſly ſtill, when brought into contact with vital air. This elaſtic fluid conſiſts of phoſphorus diſſolved in hydrogenous gas; and the hydrogenous gas is produced by the decompoſition of the water. We call it *phoſphorated hydrogenous gas.*

Sulphuric acid, diſtilled in a retort, with phoſphorus, burns it almoſt entirely, but without emitting any flame. Concentrated nitric acid acts upon it with violence, and, if the phoſphorus be hot, kindles it ſuddenly. When this experiment is made in a retort, with

nitric

nitric acid not very highly concentrated, the phoſphorus burns ſlowly, robs the nitric acid of its oxigene, and forms phoſphoric acid. This proceſs was deſcribed by M. Lavoiſier in the year 1780.

The muriatic acid does not act in a ſenſible degree on phoſphorus; but the oxigenated muriatic acid burns it with great eaſe.

If phoſphorus be dipped in the oxigenated muriatic acid gas, it kindles inſtantly, and burns with noiſe.

Nitric ſalts, with the help of a gentle heat, kindle it with great rapidity.

Sulphur and phoſphorus combine, according to Margraf, by fuſion and diſtillation. The reſult is a ſolid compound, of a fœtid ſmell, which burns with a yellow flame, and, in water, ſwells, and communicates to it the acidity and ſmell of alkaline ſulphures; which properties ſhew, that theſe two bodies re-act on each other in a peculiar manner, as their union ſeems to occaſion the decompoſition of water. M. Pelletier has obſerved, that ſulphure of phoſphorus, or phoſphorus of ſulphur, denominations that mark the reciprocal proportions of theſe two bodies, is infinitely more fuſible than either the one or other of theſe bodies apart.

Phoſphorus does not combine ſo well as ſulphur, with metals, though there be, in many particulars, a ſtrong analogy between phoſphorus and ſulphur. Margraf attempted to form theſe combinations by diſtilling each of the metallic ſubſtances with two parts of phoſphorus. None but arſenic, zink, and copper, exhibited peculiar phenomena. None of the other metals was at all altered by the phoſphorus, which was partly burnt or ſublimated in the receiver, without ſuffering any diſcernible change.

Phoſphorus ſublimated with arſenic, afforded that celebrated chemiſt, a matter of a beautiful red colour, not unlike realgar.

Zinc, diſtilled twice in ſucceſſion with this combuſtible ſubſtance, afforded yellow flowers, punctuated and very light. The ſublimate, when expoſed to the action of fire, under a red muffle, kindled, and melted into a tranſparent glaſs, like that of borax.

Copper, treated in the ſame way with phoſphorus, loſt its brilliancy, and became very compact. Its weight was increaſed ſixteen grains in the half drachm, and it burnt when expoſed to flame. M. Pelletier has obſerved, that copper combines very well with phoſphorus, and that the reſult of this combination is a ſort of grey ore, brilliant, granulated, very hard, and very difficult to melt. To theſe compounds into which phoſphorus enters unaltered, we give the name of *phoſphures* of copper, zinc, arſenic, iron, &c. M. Pelletier in his enquiries concerning metallic phoſphures, followed a very different method from Margraf. To effect theſe combinations, he mixed the metals with the vitreous phoſphoric acid and a little coal. In proportion as phoſphorus is produced by the action of the coal, it combines with the metal. In this way, he has been able to melt platina with great eaſe, and to form a phoſphure of platina, that will help to purify this uſeful metal.

The Marquis de Bullion and M. Sage have deſcribed a remarkable alteration which phoſphorus ſuffers in metallic ſolutions. The firſt of theſe chemiſts diſcovered, that ſmall pieces of phoſphorus, introduced into ſolutions of gold, ſilver, copper, &c. were gradually covered with a cruſt, or a ſort of bright metal caſe. Theſe elegant experiments ſhew, that phoſphorus has a greater affinity with oxigene than ſeveral of the metals, and is capable of reducing their oxides. Bergman has eſtabliſhed it as an unqueſtionable fact, that the arſenic acid is blackened and reduced into the ſtate of arſenic when heated with phoſphorus; which, at the ſame time, as it deprives the ſemi-metal of its oxigene, is converted into phoſphoric acid.

Phoſphorus is ſoluble in all oils; and renders them luminous. Spielman has diſcovered, that it diſſolves in alcohol, and that the ſolution emits ſparks, when poured into water. In this operation, a part of the phoſphorus is precipitated in a white powder.

Phoſphorus has not yet been much uſed, either in medicine or in the arts. Meſſrs. Menzius, Morgenſtern, Hartman, &c. ſay, that they have found it produce good effects in malignant and bilious fevers, when the ſtrength has been exhauſted, and in the miliary fever. Some authors have recommended it in the ſcarlet fever, the peripneumony, rheumatic pains, epilepſy, &c.; but though, in Germany, ſeveral diſſertations have appear- on the medicinal virtues of phoſphorus taken internally, yet nothing can be affirmed as certain on this head, till experience ſhall pronounce concerning it in a more deciſive manner.

CHAP.

CHAP. XI.

Of the Phoſphoric and the Phoſphorous Acid.

THE phoſphoric acid has been ſo called, becauſe it was thought to exiſt ready-formed in phoſphorus, from which it is obtained by combuſtion. But M. Lavoiſier has proved this ſalt to be a combination of phoſphorus with oxigene.—There are four different proceſſes for obtaining this acid. The firſt conſiſts in burning phoſphorus haſtily, under bell-glaſſes, full of atmoſpheric air, and immerſed in mercury, by the heat of a burning-glaſs, or by touching it with a red-hot iron. Care muſt be taken, to put a little water on the ſides of the glaſſes before the proceſs commence. This proceſs, invented by M. Lavoiſier, affords, in a ſhort time, a quantity of phoſphoric acid, mixed with a ſmall quantity of unburnt phoſphorus,—that is, of acid in part phoſphorous. Vital air may be uſed in the act of combuſtion. In truth, the inflammation is ſo rapid and ſo violent, as often to break in pieces the glaſſes with a noiſe. The proceſs affords phoſphoric acid.

The ſecond proceſs, which we owe to Meſſrs Woulfe and Pelletier, is performed by paſſing a ſtream of vital air through phoſphorus melted under water.

In the third, given by M. Lavoiſier, the phoſphorus is burnt by means of nitric acid, not very ſtrong.—Both theſe proceſſes produce phoſphoric acid.

The fourth proceſs, a ſlow combuſtion, which has been improperly called the formation of phoſphoric acid by *deliquium*, is very well deſcribed by M. Sage.—Sticks of phoſphorus are placed on the ſides of a glaſs funnel, the ſtalk of which enters a bottle; and its baſe is covered with a capital, the extremity of which remains open. A tube of glaſs is put into the neck of the funnel, to prevent the phoſphorus from eſcaping, and to afford, at the ſame time, a paſſage, through which the air, diſplaced by the acid, may move off. Care muſt be taken to keep the ſticks of phoſphorus from touching each other, and to prevent the temperature of the place in which the apparatus ſtands from riſing above ſixty degrees; otherwiſe the phoſphorus may probably deflagrate. In more or leſs time, there is obtained by this proceſs, for every ounce of phoſphorus, three ounces of acid, which is collected and flows, by degrees, into the water in the bottle: it is phoſphorous acid.

Theſe four proceſſes afford acid of phoſphorus, in two different ſtates, according as the phoſphorus is either not decompoſed, or entirely burnt and ſaturated with oxigene. Theſe two acids between them, exhibit phenomena, which may be compared to thoſe of the ſulphuric and the ſulphureous acids.--Such is the origin of the differences between the reſults obtained by Meſſrs. Sage and Lavoiſier, in the combinations of this acid, which are related in the Memoirs of the Academy for the year 1777, as already mentioned. We diſtinguiſh the former, that in which the phoſphorus is ſaturated with oxigene, by the name of the *phoſphoric acid;* and the ſecond, which is not entirely ſaturated with oxigene, we call the *phoſphorous acid.*

Of the Phoſphoric Acid.

PURE phoſphoric acid, obtained without the addition of water, and in vital air, is in the form of white flakes, ſnowy, light, deliqueſcent, and of a very ſtrong acid taſte. When expoſed to the air, it ſpeedily attracts moiſture. When brought into contact with a little water, it eaſily melts, and affords a white fluid, without ſmell, of an oily conſiſtency, very ponderous, of a taſte ſtrongly acid, and capable of changing blue vegetable colours rapidly into red. If expoſed to the action of fire in a retort, it affords a pure phlegm: the acid then concentrates, and becomes even more ponderous than the ſulphuric acid: it aſſumes, by degrees, conſiſtency and opacity; it is then like a ſoft extract. Laſtly, when urged with a violent heat, it melts into a tranſparent glaſs, which is hard, highly electric, and inſoluble, but exhibits none of the properties of an acid. It appears, that this ſolid vitreous ſtate of the phoſphoric acid, is owing to a more intimate combination taking place between the acidifiable baſe and the oxigene, and to the ſeparation of a part of the latter. This idea, of a more intimate adherence taking place between the oxigene and the acidifiable baſe in phoſphoric glaſs, which, as it is no longer acid, merits the name of *vitreous phoſphoric oxide*, is confirmed, when we obſerve how difficult it is to obtain from it phoſphorus, with the help of coal, and how ſtrong a heat muſt act on this mixture, to produce the deſired effect.

Phoſphoric acid obtained by ſlow combuſtion, or phoſphorous acid, when heated in an open veſſel, emits, from time to time, a faint flame, which is owing to its ſtill retaining a reſidue of phoſphorus that has not been all burnt, and the flame is accompanied with a ſmell of garlic. It then is concentrated, becomes dry, and at laſt melts like the former acid.

The concentrated phoſphoric acid very ſpeedily attracts moiſture from the atmoſphere. It combines with water, with the help of heat: it combines with a great many ſubſtances; and, in its combinations, exhibits ſome peculiar phenomena.

The liquid phoſphoric acid does not appear to have any power over ſiliceous earth, according to the experiments of Bergman and M. de Morveau: But it has been ſhewn by Dr Prieſtley and Mr Ingenhouſze, to act on glaſs.

The blow-pipe makes it bubble with aluminous earth. Phoſphoric acid, when melted in Heſſian crucibles, has been remarked, by M. de Morveau, to communicate to them a tranſparent vitreous covering.

It combines with barytes, and ſeems to prefer it to all other baſes but lime, if the affinities of this acid have been rightly marked by Bergman. The properties of barytic phoſphate are ſtill unknown.

The phoſphoric acid diſſolves carbonate of magneſia, with efferveſcence. The ſalt which it forms with this ſubſtance is ſcarce ſoluble. A concentrated ſolution of it affords, by reſt, in the ſpace of four and twenty hours, ſmall flat needle cryſtals, very ſlender, ſeveral lines in length, and cut obliquely at the two ends: it often takes the form of a tranſparent jelly. Theſe cryſtals of phoſphate of magneſia, when expoſed to a gentle heat, fall into powder. According to M. Lavoiſier, the ſulphuric acid decompoſes this ſalt.

Phoſphoric acid, poured into lime-water, precipitates from it a ſcarce ſoluble ſalt, which does not effervеſce with acids,—is decompoſed by mineral acids, but is proof againſt the attacks of cauſtic alkalis. This ſalt is of the ſame nature with the baſe of bones.—An exceſs of phoſphoric acid renders calcareous phoſphate ſoluble in water; but magneſia, lime, cauſtic fixed alkalis, and even ammoniac, by carrying off from it the exceſs of acid, precipitate the neutral ſalt. Calcareous phoſphate is not decompoſable by cauſtic alkalis; but carbonates of potaſh and ſoda decompoſe it. The ſolid matter of bones conſiſts of phoſphate ſuperſaturated with lime.

Phoſphoric acid, ſaturated with potaſh, forms a very ſoluble ſalt, which, by evaporation and cooling, affords, though not without difficulty, cryſtals, in the form of tetrahædral priſms, terminating in pyramids, which have alſo four faces, correſponding to thoſe of the priſms. This phoſphate of potaſh diſſolves much better in hot than in cold water: it ſwells on coals, but is ſomewhat obſtinate againſt melting; and when melted, has no longer a ſaline taſte. From the nitric ſolution of ſilver, it produces a white precipitate; and from the nitric ſolution of mercury, a yellowiſh white precipitate. It is decompoſed by lime-water, which has a greater affinity than potaſh, with the phoſphoric acid.

Soda, in union with the phoſphoric acid, affords a ſalt, of an agreeable taſte, much the ſame with that of muriate of ſoda. Phoſphate of ſoda does not eaſily cryſtallize, and is often reduced, by evaporation, into a gummy matter, which runs into threads like turpentine, and is deliqueſcent. I have obſerved, in this thick matter, needles diſpoſed in radii, which indicate a beginning of cryſtalliſation: But a little more ſoda than what is requiſite to ſuturate the acid, added to this ſalt, inſtantly effects a change of its properties: its taſte now becomes urinous; it turns ſyrup of violets green, cryſtalliſes in large parallelograms, and effloreſces in the air; in a word, it acquires all the properties of the fuſible ſalt with a baſe of natrum, which we call *ſuperſaturated phoſphate of ſoda*. This ſalt does not afford phoſphorus with coal; and neither phoſphate of barytes, of lime, of potaſh, nor of ſoda, is liable to ſuch a decompoſition: Wherefore it appears, that the phoſphoric acid muſt be in a naked diſengaged ſtate, in order to be decompoſed by coal.

The ammoniacal phoſphate produced by the combination of phoſphoric acid with ammoniac, is more ſoluble in hot than in cold water, and affords, by cooling, cryſtals, which, according to M. Lavoiſier, bear ſome reſemblance to thoſe of alum. I have remarked, that when the combination is truly neutral, it is very difficult to obtain it in cryſtals; for it is almoſt all evaporated even by a moderate heat. But an exceſs of ammoniac is favourable to the cryſtalliſation of this ſalt: A little phoſphate of ſoda produces the ſame effect; and this is the ſtate of that extracted from urine. Barytes, lime, and alkalis, decompoſe ammoniacal phoſphate: Fire eaſily diſengages the ammoniac; and accordingly, this ſalt affords phoſphorus with coal.

The phoſphoric acid decompoſes alkaline ſulphates, nitrates, and muriates, by the dry way; and by its fixity, diſengages the acids; but, in the humid way, it yields its baſes to theſe acids.

The phoſphoric acid, in a fluid ſtate, acts only on a few metallic ſubſtances. It diſſolves zink, and iron, and copper, readily enough. None of theſe ſolutions affords cryſtals by evaporation, except the ſolution of iron, which, indeed, ſeems ſuſceptible of cryſtallization. The others form into ſoft ductile maſſes, like extracts: when urged with fire, they emit ſparks, and appear to form genuine phoſphorus. Margraf, and the Academicians of Dijon have examined the different phenomena exhibited by this acid, in its action on metals and ſemi-metals.

The phoſphoric acid likewiſe precipitates ſome ſolutions of metals, ſuch as the ſolutions of mercury and ſilver by the nitric acid.

The nitric and acetous ſolutions of lead are, in like manner, liable to be precipitated by phoſphoric acid, and by ſoluble phoſphates. The precipitate produced by the decompoſition of the latter, which is phoſphate of lead, affords phoſphorus, when diſtilled with coal.

This acid re-acts upon oils, and improves their ſmell. To oils not naturally ſweet-ſmelling, it communicates a ſweet ſmell, in ſome degree æthereal: ſome of them it thickens.

When diſtilled, in its dry ſtate, with coal, it affords phoſphorus.

By heating it in a retort, with alcohol, the Academicians of Dijon obtained a liquor highly acid, of a pungent and diſagreeable ſmell, which burnt with a little ſmoke, and exhibited ſome of the properties of æther. The phoſphoric acid became volatile in this experiment, and ſeemed to acquire the properties of the phoſphorous acid, for the product was acid. M. Lavoiſier obſerved heat to be produced by this mixture. Moſt chemiſts, however, conſider the phoſphoric acid as inſoluble in alcohol. Margraf, Rouelle, Scheele, Meſſrs Wenzel, Laſſonne, Cornette, and the Duke de Chaulnes, recommend the uſe of alcohol to purify the phoſphoric acid, and ſeparate from it any extraneous matters which it may happen to contain.

Laſtly, phoſphoric acid, holding in ſolution phoſphate of ſoda, affords, by fuſion, an hard glaſs, inſipid, inſoluble, not deliqueſcent, and opaque, reſembling that which fuſible ſalt leaves, when urged with fire.

We may add farther, that the phoſphoric acid, which was formerly thought peculiar to urine, exiſts in a great many animal matters, as we have already ſeen, and as will farther appear in the ſucceeding chapters. Margraf informed the world of his having found it in vegetables. M. Berthollet has extracted it from ſuch as afford ammoniac by diſtillation: M. Haſſenfratz, from a great many plants growing in marſhes, and on peat-earth. It has been found in various minerals, particularly in lead and iron, with which it appears to be combined in conſequence of the decompoſition of animal ſubſtances. Laſtly, M. Prouſt has found it in combination with lime, in a ſparry ſtone, in Spain.

Of the Phoſphorous Acid.

It has been related, that when phoſphorus burns ſlowly, and is not completely ſaturated with oxigene, there is an acid formed, different from that whoſe hiſtory we have juſt finiſhed, and bearing to it the ſame relation which the ſulphureous bears to the ſulphuric, the nitrous to the nitric, and the acetous to the acetic acid. This difference between theſe two acids, in the proportion of oxigene that enters into their compoſition, occaſions

ſions a wide difference between their properties, in the ſame manner as in the other ſix which correſpond, two and two. The phoſphorus may be alſo conſidered as phoſphoric acid, holding in ſolution a little phoſphorus. This acid, when rubbed, and, ſtill more, when heated, takes a fœtid and diſagreeable ſmell: part of it is then volatilized, in a very acrid and pungent white vapour: it is then more volatile than phoſphoric acid. But this acid never riſes all in vapour, like the ſulphureous acid; it always contains more or leſs phoſphoric acid, which cauſes it to leave a vitreous reſidue, or a melted phoſphoric oxide, when treated with a ſtrong fire. It may be prepared by decompoſing phoſphoric acid; and in the production of phoſphorus, there is always a certain quantity of it diſengaged. The diſtinctive properties of the phoſphorous acid have not been all, as yet, particularly examined; but enough is known of them, to mark the difference that prevails between this and the phoſphoric acid. M. Sage, in the Memoirs of the Academy for the year 1777, has given an account of ſome of the characteriſtic properties of the phoſphorous acid. According to that chemiſt, the ſalt formed by the union of the acid obtained from phoſphorus by *deliquium*, with potaſh, or phoſphate of potaſh, is not deliqueſcent: Phoſphate of ſoda is alſo cryſtalliſable, but not deliqueſcent; but ammoniacal phoſphate attracts moiſture from the atmoſphere *.

CHAP.

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* It may be here added that *Crell*, having concentrated the phoſphoric acid to dryneſs, found its ſpecific gravity to be as 3.1 to that of water.—H.

CHAP. XII.

Of the Soft and White Parts of Animals, and of their Muſcles.

ALTHOUGH leſs progreſs has been made in the analyſis of the ſolid parts of animals, than in the analyſis of animal fluids, yet we are beginning to know ſomething of the different matters of which they are compoſed. In the firſt place, we know, that difference of texture both indicates and occaſions a difference in conſtituent principles. This aſſertion will be confirmed, by a comparative examination of the ſoft and white parts, with the muſcles and bones.

All the ſoft and white parts of animals, ſuch as the membranes, the tendons and aponeuroſes, the cartilages, the ligaments, and the ſkin, contain, in general, a mucilaginous ſubſtance, which diſſolves readily in water, but is inſoluble in alcohol, and is known by the name of *jelly*. To extract this jelly, nothing more is requiſite than to boil theſe parts of animals in water, and to evaporate the decoction, till it form, by cooling, into a ſolid tremulous maſs. When evaporated by a more violent heat, it affords a dry, brittle, tranſparent ſubſtance, that is known by the name of *glue*.

Glue is prepared from all the white parts of animals. The ſkin, the griſtles, and the feet of cows are uſed in the preparation of a ſtrong glue, in England, Flanders, Holland, &c. The ſkin of the eel is the baſis of gilder's er's glue. A ſpecies of glue, uſed by painters, &c. is prepared of the parings of glove-leather and parchment. In ſhort there is ſcarce any animal, whoſe tendons, griſtles, nerves, and ſkin—which is ſtill better for the purpoſe, may not be uſed in the preparation of theſe different ſorts of glue.

It is to be obſerved on this head, that glues differ in conſiſtency, colour, taſte, ſmell, and ſolubility. Some glues diſſolve well enough in cold water: and others are only ſoluble in boiling water. The beſt glue is tranſparent, of a yellow colour inclining to brown, without ſmell or taſte, and entirely ſoluble in water, in which it forms a viſcid fluid, of an uniform appearance, and which, when it dries, remains equally tranſparent and tenacious through all its parts.

Animal jelly differs from glue, properly ſo called, only in being leſs conſiſtent and viſcid. The former of theſe ſubſtances is obtained chiefly from the white and ſoft parts of young animals: it is alſo found in their fleſh, muſcles, ſkin, and bones. Glue is obtained only from the older animals, whoſe fibres are ſtronger and drier However, as theſe two matters exhibit the ſame chemical properties; in the examination of them, on which we are entering, we ſhall take, for our ſpecimen, the jelly that is obtained from the cartilages or membranes of the calf.

This matter has, in its natural ſtate, ſcarce any ſmell: Its taſte is inſipid. When diſtilled on a water-bath, it affords an inſipid, inodorous phlegm, liable to putrefaction. As it loſes its water, it takes the conſtſtency of glue, and, when thoroughly dried, is like horn. When expoſed to a pretty ſtrong heat, and to air at the ſame time, it ſwells, bubbles, and becomes liquid: it then becomes black, and exhales a copious ſmoke, of a fœtid ſmell: it does not take fire, unleſs when expoſed to a violent heat; and even then not readily. By diſtillation in a retort, it affords an alkaline phlegm, an empyreumatic oil, and a little ammoniacal carbonate. It leaves a coal of conſiderable bulk, which is not eaſily incinerated, and contains muriate of ſoda and calcareous phoſphate.

Jelly, expoſed to a hot and humid atmoſphere, firſt becomes acid, and ſoon putrefies.

Water diſſolves it in any proportion. Acids diſſolve it eaſily, and alkalis ſtill eaſier. The nitric acid diſengages azotic gas from it. Moſt of theſe properties are nearly the ſame with thoſe of inſipid vegetable mucilages; only, inſipid vegetable mucilages neither afford ammoniac by fire, nor azotic gas by the nitric acid. But this animal jelly may poſſibly owe theſe properties to a portion of albuminous matter, extracted by the water, at the ſame time with the gelatinous ſubſtance, eſpecially when either glue or jelly is prepared by a long and ſtrong decoction.

The muſcles of animals conſiſt of a parenchymatous cellular ſubſtance, which contains various humours, partly concrete, partly fluid. Theſe humours are compoſed, 1. Of a red and white albuminous fluid: 2. Of a gelatinous mucilage: 3. Of a ſweet oil, of the ſame nature with fat: 4. Of a peculiar extractive ſubſtance: 5. Laſtly, Of a ſaline matter, the nature of which is not very well known. As the analyſis of the fleſh entire, which affords, in the water-bath, a vapid water, and in the retort, an alkaline phlegm, empyreumatic oil, and ammoniacal carbonate, and leaves a coal that affords, by incineration, a little fixed alkali, and ſome muriate of ſoda or potaſh,—as this analyſis affords no ſatisfactory information concerning the nature of theſe different principles, recourſe muſt therefore be had to ſome means for extracting theſe ſubſtances unaltered, in order that we may be enabled to examine their properties ſeparately.

To obtain and ſeparate theſe ſeveral ſubſtances, the exiſtence of which has been aſcertained by M. Thouvenel, various modes of operation may be adopted. This phyſician ſqueezed out, in a preſs, the fluids contained in the muſcular ſponge; he coagulated the albuminous part by the action of fire, and obtained the ſalt by evaporation; he diſſolved and ſeparated the gelatinous mucilage, the ſalt, and the extract, with water; and by means of alcohol, he took off the two latter of theſe principles unmixed with jelly. It is generally very difficult to ſeparate theſe different matters exactly; becauſe they are all ſoluble in water, and alcohol diſſolves, at the ſame time, both the ſaponaceous extract, and a part of the ſalt. The proceſs which ſucceeds beſt, ſeems to be that which conſiſts in, firſt, waſhing the fleſh in cold water, which carries off the colouring matter, with a part of the ſalt; then digeſting the reſidue which remains after this waſhing, in alcohol, which diſſolves the attractive matter, and a part of the ſalt; and laſtly, boiling the fleſh in water, after treating it with theſe two proceſſes. This fluid diſſolves the gelatinous part by ebullition; and likewiſe carries off ſuch portions of the extract and the ſalt, as have eſcaped the action of the former ſolvents. A ſlow evaporation of the firſt water that was employed, in the cold, coagulates the albuminous part, which may then be ſeparated by filtration; and from this filtrated liquor, the ſaline matter may be obtained by another ſlow evaporation. By evaporating the alcohol in the ſame way, the coloured extractive matter is obtained: And laſtly, decoction ſeparates the jelly and the fat oil, which then ſwim on the ſurface, and are fixed by cooling. After the extraction of theſe ſeveral ſubſtances, nothing remains but the fibrous tiſſue: it is white, inſipid, and inſoluble in water: as it burns, it ſhrinks and contracts: it affords a good deal of ammoniac and very fœtid oil in the retort, and a good deal of gas azote by the acid of nitre. Laſtly, it poſſeſſes all the properties of the fibrous part of the blood. It appears, therefore, that the muſcular organ is the reſervoir in which the vital functions depoſite the fibrous matter; which becomes concrete by reſt, and appears to be the focus, or baſis of that property of animals, which is denominated *irritability* by phyſiologiſts.

All that now remains to be done, in order that we may gain an accurate knowledge of the fleſh of animals, is, to examine the properties of each of the ſubſtances of which it conſiſts.

The albuminous matter, jelly, and fat ſubſtance, are already known to us. The firſt is preciſely of the ſame nature with the albuminous matter of the blood; we may obſerve, that it is this ſubſtance, which, being coagulated by the heat of the water in which meat is boiled for ſoup, produces the froth which is ſo carefully ſkimmed off. This froth is of a dirty, brown-red colour;

for the original red colour of the albuminous matter is altered by the boiling heat. Jelly, obtained from fleſh, generally cauſes ſoup prepared with the fleſh of young animals, to form into a tremulous maſs; for the fleſh of young animals contains much more of it than the fleſh of old animals: it is perfectly like that which compoſes the ſoft white parts of animals, the properties of which have been explained in the preceding article. The fat matter which forms the flat round drops that ſwim on the ſurface of ſoups or broths, and becomes ſolid by cooling, exhibits all the characteriſtic properties of greaſe. We have, therefore, nothing but the extractive matter, and the ſalt that is obtained in analyſing the muſcles, to examine.

The ſubſtance which M. Thouvenel calls *mucous extractive*, is ſoluble in water, and in alcohol: it has a diſcernible taſte, whereas the jelly has none. When ſtrongly concentrated, its taſte becomes acrid and bitter: it has a peculiar aromatic ſmell, which is developed by fire. This is the ſubſtance which colours ſoups, and gives them the agreeable taſte and ſmell by which they are diſtinguiſhed. When they are too much evaporated, or when the proportion of the meat to the water is large, ſoups have then an high colour, and are more or leſs acrid in their taſte. In ſhort, the action of fire developes and improves the taſte of this extractive matter, till it, at length, gives it the taſte of ſugar or caramel, as may be obſerved of the ſurface of the roaſted meat, which is ſaid to be *criſped*. When this extractive ſubſtance is evaporated to a dry conſiſtency, and its properties ſtill farther examined, its taſte is obſerved to be acrid, bitter, and ſaltiſh: when put on a burning coal in this ſtate, it ſwells, and becomes liquid; exhaling, at the ſame time, a pungent acid ſmell, like that of burnt ſugar. If expoſed to the air, it attracts moiſture from it, and a ſaline effloreſcence is formed on its ſurface: in an hot atmoſphere, it becomes ſour and putrid, if diluted in a certain quantity of water: and laſtly, it is ſoluble in alcohol. Theſe properties render this ſubſtance very nearly of the ſame nature with the ſaponaceous extracts, and the ſaccharine matter of vegetables.

As to the ſalt which is cryſtalliſed in the ſlow evaporation of a decoction of fleſh; its nature is not yet perfectly known. M. Thouvenel obtained it in down, or in imperfectly-ſhaped cryſtals. That chemiſt thinks this to be a perfect neutral ſalt, conſiſting of potaſh, and an acid which in frugivorous quadrupeds has the characteriſtics of the phoſphoric, and in carnivorous reptiles thoſe of the muriatic acid. Although this ſalt may be conſidered as unknown till ſuch time as a ſufficient quantity of it can be collected for a particular examination; yet it is very probably either phoſphate of ſoda, or ammoniacal phoſphate; and it may even be mixed with calcareous phoſphate. Theſe ſalts are proved to exiſt here, and even with the ſame exceſs of acid as in urine, by the white precipitates which lime and ammoniac form in ſoup, as well as by the nitric ſolution of mercury producing from it a roſe-coloured precipitate.

We may add farther, that the ſubſtance the moſt plentiful in muſcular fleſh, and which peculiarly characteriſes it, is the fibrous part. This matter is depoſited from the blood, in which it exiſts in a large proportion, and acts an important part in the functions of the animal œconomy. Phyſiologiſts have not been particular enough in their accounts of its nature and properties,

ties, and of the weight and quantity of the fleſh of the muſcles, in compariſon with that of the other organs. The properties which diſtinguiſh this animal matter, are, 1. Inſolubility in water: 2. That of affording more gas azote with the nitric acid than any other ſubſtance: 3. That of affording oxalic acid and malic acid, after the gas azote: 4. That of becoming eaſily putrid when moiſtened, and affording a good deal of ammoniacal carbonate by diſtillation.

Theſe properties ſhew, that it conſiſts of a fat or oily ſubſtance, in combination with azote, of phoſphate of ſoda, and of calcareous phoſphate, which are ſeparated from it by the action of the nitric acid. I have conſidered the office of the fibrous matter in the animal œconomy, in a particular Memoir, inſerted among the Memoirs of the Royal Society of Medicine *.

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* From the animal ſubſtances chemically deſcribed in this chapter, re ſoups, glues, and ſeveral other articles for the uſe of life; common-y prepared. For making portable ſoup, 4 lib. of calves feet, 12 lib. f beef, 3 lib. of veal, and 10 lib. of mutton, are boiled and paſſed hrough different proceſſes, till they be reduced to the conſiſtency of a aſte; then divided into cakes, dried, and preſerved in bottles; to be ade into ſoup, when needed, by ſolution in warm water. The Chi-eſe alſo prepare ſomewhat in this manner, from animal ſubſtances, hoſe cakes of *hockiac* which are uſed in diſorders of the lungs. Al-oſt all glues are prepared from animal ſubſtances. They differ only being, ſome weaker, ſome ſtronger. That glue which is called iſin-laſs, is indeed prepared from the mucilaginous parts of a large fiſh und in the Ruſſian ſeas: It is uſed chiefly by the ſilk and ribbon ma-ufacturers. Glue is alſo made from eel-ſkins, from ſnails, and from e clippings of parchment. The glue or ſize, uſed by paper-manu-cturers, is made from wheat-flour.—H.

CHAP. XIII.

Of the Bones of Animals.

THE bones are the ſupport of all the other parts of animals,—the baſis on which all the ſoft parts reſt. Theſe hard parts are not to be conſidered as paſſive in the animal œconomy: they are actually ſecretory organs, and ſeparate from the blood and other juices, a peculiar ſaline matter, of which their own ſubſtance is formed, and which is deſigned to be accumulated in them as reſervoirs.

The bones, conſidered as they exiſt in all animals, from man to the inſect and the worm, differ in texture, in ſolidity, in poſition with reſpect to the muſcles, and probably in the nature of their component principles. Chemical analyſis has not yet aſcertained any thing concerning this laſt particular. But one cannot help thinking, that the bones of men and quadrupeds muſt be of a different nature from thoſe of fiſhes and reptiles, and ſtill more different from the corneous ſkeleton of inſects, and from the calcareous covering of ſhell-worms. The particular light in which we are here to examine the bones of animals, does not permit us to inſiſt on theſe diſtinctions; and chemiſts have not yet made any reſearches that can enable phyſiologiſts to determine concerning them.

The bones of men and quadrupeds, the only bones that have yet been examined by chemiſts, are not earthy matters, as was once thought. They contain a certain quantity of gelatinous matter diſperſed through the ſmall cavities which intervene between the ſolid plates of which their texture is compoſed; and thoſe ſolid plates, too, which, from their inſolubility and conſiſtency, were taken for earthy matters, have been, within theſe few years, diſcovered to conſiſt of a true neutral ſalt, the component principles of which are phoſphoric acid and lime.

Bones, when expoſed to fire, with concourſe of air, kindle, in conſequence of their containing a certain quantity of medullary fat. When diſtilled in a retort, they afford an alkaline phlegm, a fetid empyreumatic oil, and a conſiderable proportion of ammoniacal carbonate. The coal which they leave is compact, and ſomewhat difficult to incinerate. It leaves a white reſidue, which, when waſhed in cold water, affords a ſmall quantity of carbonate of ſoda. Hot water then ſeparates from it a certain quantity of ſulphate of lime. What remains after theſe lixiviations, is not ſoluble in water: it is the calcareous phoſphate which Dr Gahn of Stockholm diſcovered, in the year 1769, to exiſt in bones. Bones calcined in the focus of a furnace, among coals, remain luminous in the dark: when urged with a very violent heat, they are half-vitrified, and are thus reduced to a ſort of hard porcelain, very white, and ſemi-tranſparent. This property ſeems to be owing to the phoſphoric acid: It might be made the ſubject of a particular art in pottery.

The water in which bones grated down are boiled, is charged with a ſubſtance which renders it viſcid, and is a true gelatinous matter.

Alkaline carbonates are capable of decompoſing the calcareous phoſphate which forms the baſis of bones. This decompoſition is mentioned by the chemiſts of the Academy of Dijon; they ſay, that they effected it on treating, by fuſion, a mixture of powder of calcined bones, and carbonate of potaſh.

Acids act upon bones, and decompoſe the calcareous phoſphate contained in them. It was by this means that Scheele, in the year 1771, prepared phoſphorus from bones. He diſſolved the bones in nitric acid. The acid ſeizing the lime contained in them, formed with it calcareous nitrate, which remained in ſolution, while the phoſphoric acid was diſengaged. Into this mixture he poured ſulphuric acid, which, by detaching the lime from the calcareous nitrate, formed ſulphate of lime: this ſulphate of lime being precipitated as inſoluble, he ſeparated it by filtrating the liquor. Laſtly, he diſtilled in a retort the filtrated liquor, which was a mixture of nitric acid and phoſphoric acid; and after evaporating it to the conſiſtency of ſyrup, heated it with coal, in order to obtain from it phoſphorus. Meſſrs Poulletier de Salle and Macquer were the firſt who repeated theſe ingenious experiments at Paris. After that, the academicians of Dijon, M. Rouelle, M. Prouſt, and M. Nicolas de Nancy, communicated their reſearches and proceſſes on the ſame matters, to the public. Various other chemiſts have vied with theſe in examining the different ſolid matters of animal bodies. Among others, M. Berniard has obtained phoſphoric acid from foſſil bones, from whale-bones, from the bones of the elephant and the porpoiſe, from thoſe of the elk, from thoſe of the cow, from human bones, from the teeth of the ſea-cow, and from the grinders of the elephant; and he has obſerved, that all theſe bones afford the ſame ſubſtances, and contain phoſphoric acid in various proportions. The Marquis de Bullion has obtained phoſphoric glaſs from ivory, and from the bones of fiſhes.

The proceſs moſtly followed at preſent, in extracting phoſphoric acid from bones, is that of the chemiſts of Dijon and St. Nicolas. The bones are burnt white, reduced to powder, and paſſed through a ſieve: they are then mixed, in a veſſel of ſtone-ware, with an equal quantity of concentrated ſulphuric acid, and as much water is added as is ſufficient to give the whole the conſiſtency of clear ſoup: the mixture is now ſuffered to reſt for ſome hours, in the courſe of which it becomes thick; it is then poured on a filtre of double cloth, and waſhed with water till the fluid paſs through clear, and without acquiring any taſte, or the property of precipitating lime-water. It is then certain, that the reſidue contains no naked phoſphoric acid: the water which has been uſed in the waſhings is now evaporated; it depoſites, by degrees, a white matter, which is ſulphate of lime, and muſt be ſeparated by the filter.

This ſalt muſt be carefully waſhed, in order to carry off all the phoſphoric acid: theſe filtrations are to be repeated till the liquor ceaſe to afford any ſediment. The evaporation muſt be continued till it acquire the conſiſtency of honey, or a ſoft extract. Its colour is then brown, and its appearance greaſy. It is next put into a crucible, and heated till it ceaſe to exhale a ſulphureous and ſomewhat aromatic ſmell which at firſt ariſes from it,—and till it ceaſe to bubble. In this ſtate, the conſiſtency of this matter is half-vitreous, and its taſte acid: it attracts moiſture from the atmoſphere. If urged farther with heat, it melts into a tranſparent glaſs, which is hard, inſipid, and inſoluble, and exhibits no mark of acidity. To obtain phoſphorus from it, there is no occaſion for waiting till this reſidue of the acid liquor, after evaporation, be brought into the ſtate of an inſoluble glaſs. In this ſtate greater ſtrength of fire is requiſite; and even with that it yields phoſphorus much ſlower than when ſoft and deliqueſcent. To reduce this glaſs into phoſphorus, it muſt firſt be brayed to powder; then mixed with a quantity of dry charcoal, equal to one third of its own weight; next put into a ſtone-retort, with a balloon half full of water fitted to it, which balloon muſt be pierced with a ſmall hole, or connected by a ſyphon with Woulfe's apparatus. Fire is to be gradually applied till the retort be firſt reddened, and then rendered white; the phoſphorus then runs in drops; and the operation laſts, altogether, from ſeven or eight, to ten or twelve hours, according to the quantity of the matter that is diſtilled, and the degree of heat which the furnace is able to bear. Six pounds of bones uſually afford twenty ounces, or ſomewhat more of a vitreous reſidue; and this reſidue affords about three ounces of very fine phoſphorus, and a few drachms of phoſphorus half decompoſed. When the deſign is to prepare phoſphorus of the phoſphoric acid of bones, the acid muſt be evaporated to the conſiſtency of an extract, and diſtilled with coal. Phoſphorus is much more readily obtained by this proceſs than by any other.

The caſe is the ſame with the acid product obtained from bones by the action of the ſulphuric acid, as with the reſidue of ammoniacal phoſphate decompoſed by fire. That product is not pure phoſphoric acid; for it never affords more than one fifth of its weight of phoſphorus: it ſeems to contain a certain quantity of phoſphate of ſoda. When this ſalt is mixed with calcareous phoſphate produced from a little ſulphate of lime, it uſually melts with that phoſphate, and forms with it a very hard opaque glaſs, which reſiſts the action of all menſtrua.

M. de Morveau has propoſed a method for obtaining very pure ammoniacal phoſphate from the phoſphoric acid of bones. In order to that, diſſolve the bones after calcination, in weak ſulphuric acid; aſſay the ſolution with a ſolution of bones in the nitric acid, in order to aſcertain whether there ſtill remain in it any ſulphuric acid in a naked ſtate: then precipitate, by cauſtic ammoniac, the calcareous phoſphate which it contains,—as has been done by M. Wiegleb, in his proceſs: filtrate the liquor; and leave it to evaporate in the open air. You thus obtain very beautiful cryſtals of ammoniacal phoſphate, mixed with a little phoſphate of ſoda which ſeparates by efflોreſcence: the calcareous phoſphate remaining on the filter may be likewiſe decompoſed, in order to form phoſphorus from it.

CHAP. XIV.

Of various Subſtances of Uſe in Medicine and the Arts, which are obtained from Quadrupeds, the Cetaceous Animals, Birds, and Fiſhes.

WERE my deſign to give a minute and accurate hiſtory of all the animal ſubſtances uſed in medicine and the arts, I ſhould have occaſion to ſay more on this ſingle head, than I have hitherto ſaid concerning the whole animal kingdom; eſpecially when I ſhould come to mention the different animal matters that were formerly introduced into medicine, by quackery or credulity, as famous ſpecifics, and are now happily conſidered as entirely uſeleſs. I intend only to mention the principal of thoſe ſubſtances,—ſuch as chemical and medical experience has aſcertained to poſſeſs powerful virtues, and ſuch as are at preſent much uſed in the arts.

Of the matters which quadrupeds afford, we ſhall conſider only caſtoreum, muſk, and the hart's-horn. The white of the whale, and ambergriſe, are the only products of cetaceous animals which will be here treated of. Of the products of birds, we ſhall give an analyſis of the egg. Among oviparous quadrupeds and ſerpents, the tortoiſe, the frog, and the viper, will deſerve to be ſeparately conſidered. The only product of fiſhes which we ſhall examine, is the ichthyocolla. Inſects will afford numerous ſubjects for examination: we ſhall conſider cantharides, ants, wood-lice, honey and wax, ſilk, and the ſilk-worm, gum lac, kermes, cochineal, and crabs ſtones. Laſtly, we ſhall cloſe our examination of the products of the animal kingdom, with conſidering the nature of the coral and çorallines, which belong to the claſs of worms or polypi.

From this brief enumeration of the matters which we mean here to conſider, it will appear, that we mean to take no notice of a great many other animal matters which were formerly uſed in medicine; ſuch as, among others, ivory, the unicorn's horn, the teeth of the hippopotamus, of the beaver, and of the boar, the bones of the ſtag's heart, the feet of the elk, bezoar, civet, and the blood of the wild goat, among quadrupeds; the ſwallow's neſt, gooſe greaſe, peacock's dung, and the membrane of the ſtomach of poultry, among birds; the toad and the ſcincus, among oviparous quadrupeds; the gall and ſtones of the carp, the liver of the eel, the bones of the perch, and the jaws of the pike, among fiſhes; the ſcarabæus, the ſpider's web, the meloe or proſcarabæus, and the claws of the crab, among inſects; laſtly, ſhell-worms, ſnails, oyſter-ſhells, *nacres* of pearls, and bones of the cuttle fiſh, among the naked or covered worms. Of theſe ſubſtances, ſome poſſeſs none but imaginary virtues; and the uſes of others are better ſupplied by the ſubſtances which we have ſelected for examination.

§ I.

§ I. *Of Caſtoreum.*

The name of *Caſtoreum* is given to two bags ſituated in the inguinal region of the male or female beaver, containing a ſtrongly odorous matter, which, when they are newly taken from the animal, is ſoft and almoſt fluid, but in the courſe of time becomes dry, and acquires the conſiſtency of a reſin. This matter has an acrid, bitter, and nauſeous taſte; its ſmell is ſtrong, aromatic, and even fœtid: it conſiſts of a coloured reſin, ſoluble by alcohol and ether; a gelatinous, and partly extractive mucilage, which are taken up by water; and a ſalt, which cryſtalliſes when the aqueous ſolution is evaporated, but of which the nature is not yet known. The reſin of caſtoreum, ſeems to be very nearly of the ſame nature with that of the bile. The whole of this animal product is included in membranous cells which proceed from the internal tunic of the bag in which they are contained. Caſtoreum has never yet been properly analyſed: we know only that it affords a little volatile oil, and ſome ammoniacal carbonate, by diſtillation; and that, by means of æther, alcohol, and water, the ſeveral matters of which it conſiſts may be ſeparated.

It is uſed in medicine as an antiſpaſmodic, in hyſteric and hypocondriac caſes, and in the convulſions occaſioned by thoſe affections. It often produces the happieſt effects very ſpeedily; but at other times it irritates, inſtead of ſoothing; its effects being either favourable or unfavourable, according to the particular character of the nervous ſyſtem of the patient. It ought therefore to be adminiſtered only in ſmall doſes, when it is firſt given.

It has been alſo preſcribed with ſucceſs for the epilepſy and tetanus. It is uſually given in doſes of from a few grains to half a drachm; it is made into boluſes; it is generally, and almoſt always with good effects mixed with opium, and all calming or narcotic extracts. It is likewiſe uſed in a ſpiritous and an æthereal tincture, of which, from a few drops to four and twenty or ſix and thirty grains are given in certain drinks.

§ II. *Of Muſk.*

Musk, a ſubſtance of which the ſtrong and permanent ſmell is generally known, is contained in a bag ſituated near the umbilical region of a ruminating quadruped ſo like the antelope, that it ſcarce deſerves to be ranked under a different genus. This matter, in its chemical properties, reſembles caſtoreum. It is a reſin, combined with a certain quantity of mucilage, bitter extract, and ſalt. Factitious muſk is often ſold inſtead of the real. Its virtues are ſuperior to thoſe of caſtoreum: it is more active; and is therefore never employed but in caſes of extreme urgency. It is given as a potent antiſpaſmodic, in convulſive diſorders, in the hydrophobia, &c. It is likewiſe conſidered as a violent aphrodiſiac. It ſhould be very cautiouſly uſed; for it often excites, inſtead of allaying nervous affections.

§ III. *Of Hartſhorn.*

Hartshorn is one of thoſe animal ſubſtances which are the moſt uſed in medicine. It it a bony ſubſtance, and does not in any reſpect differ from bones. It contains a conſiderable quantity of ſoft jelly, very light and nouriſhing, which is extracted by boiling it, after it has been firſt reduced into ſmall pieces, in eight or ten times its own weight of water. By diſtillation in a retort, it affords a reddiſh ammoniacal phlegm called *volatile ſpirit of hartſhorn*, an oil more or leſs empyreumatic, and a great quantity of ammoniacal carbonate contaminated with a little oil. There is diſengaged from it a very large proportion of elaſtic fluid, conſiſting of a mixture of carbonic acid gas, gas azote, and hydrogenous gas with carbonaceous matter and even volatile oil diſſolved in it. The oil, however, is gradually precipitated by cooling; it then adheres to the ſides of the glaſs veſſels containing the elaſtic fluid. As the volatile ſalt is coloured, it muſt be digeſted in a little alcohol, to free it of the oil by which it is contaminated. The carbonaceous reſidue, when incinerated, is found to contain a little carbonate of ſoda, ſome ſulphate of lime, and a conſiderable quantity of calcareous phoſphate mixed with phoſphate of ſoda—which, as has been mentioned in the article of bones, is to be decompoſed with ſulphuric acid.

The ſpirit and ſalt of hartſhorn are uſed in medicine, as good antiſpaſmodics. The former, ſaturated with ſuccinic acid, forms the ſuccinated liquor of hartſhorn.

Oil of hartſhorn, when rectified by a gentle heat, becomes very white, ſtrongly odorous, highly volatile, and almoſt as inflammable as æther. It is known by the name of *animal oil of Dippel*, a German chemiſt, who was the firſt that prepared it. It uſed formerly to be rectified a great many times, in order to render it very white and fluid. But it has ſince been obſerved that two or three diſtillations are ſufficient, provided care be taken, 1. To introduce the oil that is to be rectified, into the retort, through a long funnel, in order that the neck of the veſſel may be very clean; for, a ſingle drop of coloured oil would be enough to colour the whole quantity under diſtillation: and, 2. To take only the firſt portions, which are the whiteſt, and the moſt volatile. For theſe obſervations, we are indebted to Meſſrs Model and Baumé.—Rouelle has likewiſe given a very good proceſs for obtaining this oil; it conſiſts in diſtilling it with water. As none but the moſt volatile part, which is truly æthereal, and entirely contained even in the oil of the firſt diſtillation, can be volatilized by the heat of boiling water, we are ſure of obtaining, by this mode of operation, nothing but the moſt ſubtle and penetrating part. This oil has a lively ſmell, and is amazingly light and volatile: it exhibits all the properties of vegetable volatile oils; and ſeems to differ from them only in containing ſome ammoniac; for, it turns ſyrup of violets green, as has been obſerved by M. Parmentier. This oil is uſed, in drops, in caſes in which the nerves are affected, in the epilepſy, &c *.

§ IV. *Of the White of the Whale.*

The white of the whale, improperly called *ſpermaceti*, is an oily matter, concrete, cryſtalline, ſemi-tranſparent, and of a peculiar ſmell, which is taken from the

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[*] M. Chaptal, in rectifying the empyreumatic oil of hartſhorn, has been accuſtomed to diſtill it with earth of murriel, which retaining all the colouring part, gives the oil at once white and attenuated.—H.

the cranium of the cachalot, from two particular cavities diſtinct from the brain, and is purified by liquefaction, and by the ſeparation of another oil, fluid, and not ſuſceptible of concretion, which is mixed with it. This ſubſtance diſplays very ſingular chemical properties, in which it nearly reſembles both fixed and volatile oils.

The white of the whale, when heated in contact with air, kindles, and burns in an uniform manner, without diffuſing any diſagreeable ſmell. Excellent candles are therefore made of it, in thoſe places where it is prepared, at Bayonne, at St Jean-de-Luz, &c. In England, there are many manufactories of theſe candles: within theſe few years, ſome ſuch have been eſtabliſhed at Paris.

When diſtilled by naked fire, it does not, according to M. Thouvenel, yield any acid phlegm, like fixed oils, but paſſes entire, and almoſt unaltered, into the receiver, as ſoon as it begins to boil; leaving on the retort a carbonaceous mark. On repeating the operation, it loſes its ſolid form, and remains fluid, without becoming more volatile.

The white of the whale, when expoſed to hot air, becomes yellow and rancid, but not ſo eaſily as other fixed concrete oils. Water in which it has been boiled, affords, by evaporation, nothing but a light mucoſo-unctuous reſidue.

Cauſtic alkali diſſolves the white of the whale, and forms with it a ſoap which, by degrees, becomes ſolid, and at length friable.

The nitric and the muriatic acids are incapable of acting on this ſubſtance. The concentrated ſulphuric

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acid diſſolves it, and, at the ſame time, alters its colour: this ſolution is precipitated by water, like oil of camphor.

The white of the whale combines with ſulphur, like fixed oils.

Fixed and volatile oils diſſolve the white of the whale, with the help of heat. Hot alcohol likewiſe diſſolves it, but ſuffers it to precipitate by cooling. Æther effects this ſolution cold, or, at leaſt, without the help of a greater heat than the natural warmth of the hand.

Perhaps, the white of the whale may bear the ſame relation to fixed oils which camphor bears to volatile oils. It differs eſſentially from wax, which ſeems to bear the ſame relation to the former, as reſin to the latter.

Formerly, this ſubſtance was very much uſed in medicine; a great variety of medicinal properties were aſcribed to it. It was uſed, eſpecially, in caſes of caarrh, eroſions, ulcers of the lungs and reins, &c. At reſent, it is employed as a demulcent medicine; and, ven for this purpoſe, in very ſmall dozes, and mixed ith mucilages; for it is allowed to be heavy upon the omach, and to occaſion diſguſt, nauſea, and even voiting.

I have found, in animal matters, eſpecially in the arenchyma of the liver, after drying it in the air for metime, in the muſcles of animals altered by putrection, and in human biliary concretions, a matter ſſeſſing nearly the ſame properties with the white of e whale. This ſubſtance, therefore, appears to me be very copious among animal matters, and to be oil peculiar to this department of nature.

§ V. *Of Ambergriſe.*

AMBERGRISE is a concrete matter, of a ſoft tenacious conſiſtency like wax, of a grey colour, marked with yellow or black ſpots, and of a ſtrong, ſweet ſmell, when it is heated or rubbed. It exiſts in irregular maſſes, which are ſometimes round, and conſiſt of layers of different ſorts, and either greater or ſmaller, according as the number united in the maſs is greater or leſs. There have been pieces of it ſeen, which weighed more than two hundred pounds. This ſubſtance appears evidently to have once been in a liquid ſtate, as various extraneous matters are found incorporated with it; ſuch as the neb of the cuttle fiſh, bones of fiſhes, and other marine bodies. Ambergriſe is found floating on the waters of the ocean near the Molucca Iſles, Madagaſcar, Sumatra, and on the coaſts of Coromandel, Brazil, Africa, China, and Japan. Some American fiſhermen informed Dr Schwediaur, an Engliſh phyſician, that they had often ſeen this matter among the excrements of that ſpecies of the whale which Linnæus calls *phyſeter macrocephalus*, in his inteſtines, or in a bag ſituated as i ſaid, beſide them, and probably the cæcum. Naturaliſts take notice of a good many varieties of ambergriſe. Wallerius reckons the ſix that follow:

Varieties.

1. Grey ambergriſe, with yellow ſpots.
2. Grey ambergriſe, with black ſpots.

These two varieties are the moſt valuabl and the moſt in requeſt.

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3. White ambergriſe, of only one colour.
4. Yellow ambergriſe, of no more but one colour.
5. Brown ambergriſe, of a ſingle colour.
6. Black ambergriſe of a ſingle colour.

It is to be obſerved, that theſe varieties are owing to a mixture of ſome extraneous ſubſtances.

There is a great diſagreement among philoſophers concerning the origin of ambergriſe. By moſt of them, it has been conſidered as a bitumen,—a ſort of petroleum, iſſuing from the rocks, and condenſed by the action of the ſun and the water of the ſea. Others have imagined it to be made up of the excrements of birds nouriſhed on odoriferous herbs. Others, again, have aſcribed its origin to the froth thrown out by ſea-calves, the excrements of the crocodile, &c. Pommet and Lemery thought it a mixture of wax and honey, hardened by the action of the ſun, and altered by the ſea-water. M. Formey, who has adopted this opinion, ſupports it by an experiment which conſiſts in digeſting wax and honey. He aſſerts, that a product may thus be formed, of an agreeable ſmell, nearly the ſame with that of ambergriſe.—Some Engliſh authors have conſidered ambergriſe as an animal juice, depoſited in bags ſituated near the root of the genital organ in the male whale; and others have imagined, that it is formed in the bladder of that cetaceous animal: But the nebs of cuttle-fiſhes found in this concrete juice, are ſufficient to confute theſe opinions. Laſtly, Dr Schwediaur, after examining a great many ſpecimens of ambergriſe, and receiving accounts concerning it from different navigators,

vigators, has concluded this ſubſtance to be formed in the alimentary canal of the *phyſeter macrocephalus*,—the ſpecies which affords the *ſpermaceti*, or white of the whale. He conſiders ambergriſe as an excrement of this cetaceous animal, mixed with ſome parts of its food,—1. Becauſe fiſhermen find it in theſe whales: 2. Becauſe it is common in the latitudes which they inhabit: 3. Becauſe beaks of the cuttle-fiſh with eight feet, *ſepia octopoda*, on which that animal lives, are always found in it: 4. Becauſe he diſtinguiſhed the black ſpots mixed through ambergriſe to be the nebs of this polypous animal. 5. Laſtly, Becauſe the excrements of ſeveral quadrupeds, as cows, hogs, &c. exhale an odour ſimilar to that of ambergriſe, when kept for any length of time. His reſearches have raiſed this opinion of the Japaneſe, and of Kempfer, to an high degree of probability; for which reaſon, we now rank this matter among the products of the animal kingdom.

Yet this ſubſtance, which has been analyſed by Geoffroy, Neuman, Grim, and Brown, afforded to thoſe chemiſts the ſame principles with bitumens; that is to ſay, an acid ſpirit, a concrete acid ſalt, ſome oil, and a carbonaceous reſidue. But Dr Schwediaur obſerves, with great propriety, that the calculi of animals afford an acid, and that the exiſtence of this ſalt is in favour of his opinion, for fat contains a great deal of it.

Ambergriſe is ſtomachic, cordial, antiſpaſmodic. It is uſed in doſes of ſeveral grains, in certain drinks, or mixed with other ſubſtances, in pills. The odorous principle of this medicine is often too active, too penetrating and liable to do harm. It is well known, that many perſons cannot bear the ſmell of it without feeling their nerves very diſagreeably affected: it ſhould therefore be adminiſtered very cautiouſly. It has been alſo conſidered as a powerful aphrodiſiac. Some phyſicians, however, think that ambergriſe may be preſcribed in very copious doſes, without producing any very powerful effects.

Ambergriſe is chiefly uſed as an article of perfume, for the toilet: it is uſually mixed with muſk, the ſmell of which it weakens ſo as to render it much more agreeable. Yet every perſon is not fond even of this mixture.

As ambergriſe is very dear, it is counterfeited and mixed with different ſubſtances. When genuine, it diſplays the following properties: It is ſcaly, inſipid, and ſweet-ſmelling; it melts without riſing in bubbles or froth, when expoſed, in a ſilver-ſpoon, to the flame of a taper; it ſwims on water, and does not ſtick to hot iron. Ambergriſe which does not exhibit theſe properties, is to be conſidered as impure.

§ VI. *Of the Eggs of Birds.*

Birds' eggs, particularly hen-eggs, conſiſt, 1. Of a bony ſhell, which has been ſhewn by M. Berniard, to contain a jelly, and calcareous phoſphate; 2. Of a membranous pellicle, immediately under the ſhell, which appears to be a tiſſue of fibrous matter; 3. Of white; 4. Of yellow, incloſed and ſuſpended in the middle of the white. On this laſt ſubſtance the germ is ſupported.

The white of the egg is preciſely of the ſame nature with the ſerum of the blood; it is viſcid and adheſive:

it communicates a green colour to ſyrup of violets; and contains carbonate of ſoda, in a naked ſtate. By a gentle heat, it is coagulated into an opaque, white maſs, which exhales the fetid ſmell of ſulphurated or hepatic hydrogenous gas. This white, when coagulated and dried on a water-bath, affords an inſipid phlegm, which putrefies, and acquires the dryneſs and reddiſh tranſparency of horn. By diſtillation in a retort, it affords ammoniacal carbonate, and empyreumatic oil: its coal contains ſoda, and a little calcareous phoſphate. M. Deyeux likewiſe obtained a little ſulphur from it, by ſublimation.

The white of the egg, when expoſed to the air in thin layers, rather becomes dry than putrid, and forms a ſort of tranſparent varniſh. It diſſolves in water in any proportion. Acids coagulate it: This coagulum, when diluted in water and filtered, affords, by evaporation of the filtered liquor, a neutral ſalt, conſiſting of the acid which was employed, and the ſoda contained in this fluid. Alcohol likewiſe coagulates the white of the egg. Lime-water precipitates calcareous phoſphate from it; and nitrate of mercury produces phoſphate of mercury, which takes a roſe-colour by deſiccation.

The yellow, or yolk of the egg, conſiſts moſtly of albuminous matter, mixed, however, with a certain quantity of ſweet oil; ſo that this mixture diſſolves in water, and forms a ſort of animal emulſion called *hen's milk*. When expoſed to the action of fire, it is reduced to a maſs, not ſo ſolid as that which the ſame agent forms from the white. When dried, it becomes ſoft, in conſequence of the diſengagement of its oil, which exſudes from its ſurface. By ſubmitting it to the preſs, i

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this ſtate, that oil is obtained, and is found to be ſweet and fat, and of a ſmell and taſte, in a ſlight degree, empyreumatic. The yolk of the egg diſtilled, after the extraction of this oil, affords the ſame products as other animal matters. Acids and alcohol coagulate it. The eggs of animals, as containing ſweet oil, bear a great reſemblance to the ſeeds of many vegetables; for theſe likewiſe contain a ſweet oil, united in the ſame manner with a mucilage, and reduced to an emulſive ſtate.

Eggs are very much uſed as an article of food. Their different parts are uſed in pharmacy and medicine. The ſhell is calcined, and employed as an abſorbent. The oil of the egg is demulcent; it is applied externally, to cure burnings, chaps, &c. The yolk of the egg renders oils ſoluble in water, and thus forms lohochs: it is triturated with reſins, camphor, &c. The white of the egg is of conſiderable uſe in pharmacy and confectionary, to clarify the juices of plants, wheys, ſyrups, and other fluids. It is alſo laid on paintings, which it preſerves by forming a tranſparent varniſh on their ſurface.

§ VII. *Of Ichthyocolla.*

ICHTHYOCOLLA, or fiſh-glue, is a ſubſtance partly gelatinous, partly lymphatic, which is prepared by rolling up the membranes that form the air-bladder of the ſturgeon, and ſome other fiſhes, and leaving them to dry in the air, after twiſting them into the form of a ſhort cord,—in which we receive them. This matter affords a viſcous jelly, when boiled in water. When left to macerate in that fluid, it may be unfolded and extended into a ſort of membrane. It is never brittle, like glues properly ſo called; but its fibrous and elaſtic texture renders it always ſuſceptible of being twiſted. There is alſo a ſpecies of it prepared from a decoction of the ſkin, the ſtomach, and the inteſtines of fiſhes; but this ſpecies is not equally valuable in the arts. All the products of other animal ſubſtances are obtained from ichthyocolla. It may be employed in medicine, as an emollient, in diſorders affecting the throat, the inteſtines, &c.; but ſeveral vegetable ſubſtances, poſſeſſing the ſame virtues, are commonly preferred. It is uſed in the arts, to clarify liquors, wine, coffee, &c. It attracts and precipitates all extraneous matters, altering their tranſparency.

§ VIII. *Of the Tortoiſe, the Frog, and the Viper.*

The tortoiſe, the frog, the lizard, and the viper, are very much uſed in medicine: decoctions or ſoups, to which peculiar virtues have been aſcribed, are prepared of them. In fact, animals whoſe component parts in general, are ſtrong-ſmelling, and are found to contain a good deal of ſaline matter, by affording a conſiderable quantity of ammoniac, when diſtilled by a gentle heat after being triturated with potaſh;—it would appear, that ſuch animals muſt poſſeſs more numerous and more powerful virtues than others. Many phyſicians, however, doubt of the ſingularity of their virtues, and claſs them with other animals. Notwithſtanding this opinion, turtle and frog ſoups are ſtill adminiſtered in diſeaſes attended with languor, in conſumptions ſions without apparent cauſe, and in recovery from acute diſeaſes,—and are often attended with good effects. It appears, that decoctions of theſe animal ſubſtances are peculiarly nouriſhing, light, and pleaſant, and perhaps, are at the ſame time, poſſeſſed of a peculiar activity, as their ſtrong ſmell and uncommon taſte ſeem to indicate. Within theſe few years, the uſe of green lizards has been recommended in diſorders affecting the ſkin, and cancers; but we may venture to doubt of their virtues.

Vipers are thought peculiarly active. The ancients talked much of their virtues in diſorders affecting the ſkin, in diſorders of the breaſt, and in chronical diſtempers in which the lymph is vitiated. One cannot help thinking, that viper ſoups muſt occaſion depuration by the ſkin, by virtue of their powerful aroma. The powder and volatile ſalt of theſe animals are far from poſſeſſing the ſame virtues. To produce their full effects, theſe animals ſhould be adminiſtered altogether as articles of food in the above diſeaſes.

M. Thouvenel obtained from theſe animals, by chemical analyſis, a jelly more or leſs light, either conſiſtent or viſcid,—an acrid extract, bitter and deliqueſcent,—a concreſcible albuminous matter,—an ammoniacal ſalt,—and an oily ſubſtance, of a peculiar taſte and ſmell, and ſometimes ſoluble in alcohol, &c.

§ IX. *Of Cantharides.*

CANTHARIDES, a medicine ſo valuable for its corroſive and epiſpaſtic powers, conſiſt, according to M. Thouvenel, 1. Of a parenchyma, the nature of which he has not determined, and which compoſes one half of the weight of the dried inſect: 2. Of three drachms to the ounce of a reddiſh-yellow extractive matter, exceedingly bitter, which affords acid by diſtillation: 3. Of twelve grains to the ounce of a yellow, wax-like matter, to which the golden yellow colour of cantharides is owing: 4. Of ſixty grains of a green, oily, wax-like ſubſtance, of an acrid taſte, in which the ſmell of cantharides chiefly reſides. This ſubſtance affords by diſtillation, a very pungent acid, and a concrete, wax-like oil. Water diſſolves the extract, the yellow oil, and even a little of the green oil; but æther acts only on the laſt, and may therefore be ſucceſsfully employed to ſeparate it from the others. The virtue of cantharides is owing to this green wax. To extract this, together with the extractive matter, and by ſuch means form a tincture charged with the ſubſtance of theſe inſects, a mixture conſiſting of equal parts of alcohol and water, muſt be employed. When this mixed tincture is diſtilled, the alcohol retains a faint ſmell of cantharides; and the ſeveral matters contained in it are ſeparated, as the evaporation takes place.

§ X. *Of Ants and the Formic Acid.*

The acid of ants has been obſerved by Tragus, Bauhin, and ſeveral other botaniſts, who perceived the flower of chicory to become very red in an ant-hill. Samuel Fiſher, Etmuller, and Hoffman, ſucceſſively examined it. Margraf examined it with great care, and found that ants contain a peculiar acid, a fixed oil, and an extract. Meſſrs Ardwiſſon and Oerhne have made the moſt complete ſeries of experiments on this acid.

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This acid is obtained, eſpecially from the great red ant, *formica rufa*, either by diſtillation in a retort, or by lixiviation with boiling water. This acid, when rectified, and a little concentrated, has a pungent ſmell: it is burning: its taſte is pleaſant, when diluted with a large proportion of water; it has therefore been propoſed as a ſeaſoning inſtead of vinegar. It ſpeedily reddens all blue vegetable colours: it is decompoſed by fire, which converts one part of its principles into carbonic acid; and by the ſulphuric and the nitric acids, which alſo extricate from it the ſame acid. It detaches oxigene from the oxigenated muriatic acid: it is ſtronger than the ſulphuric, the boracic, the carbonic, the acetous, or the nitrous acid. It forms a ſort of æther with alcohol. The neutral ſalts which it forms with alkaline baſes, have been examined by Meſſrs Ardwiſſon and Oerhne. Formiate of potaſh has been prepared by M. Thouvenel, by ſpreading cloths, previouſly dipped in potaſh, over ant-hills which had been opened up: the ants running upon the cloths, depoſited upon them as much of their acid, and of the odorate principle which they exhale in great abundance, as was ſufficient to ſaturate the fixed alkali. The lixivium formed upon theſe cloths, afforded, by evaporation, a neutral ſalt in flattened parallelograms, or priſmatic columns, and not deliqueſcent.

Lime forms with this acid, a cryſtalliſable and ſoluble ſalt. In a word, modern chemiſts conſider the formic as a peculiar acid. Its affinities have been arranged in the following order, by Meſſrs Ardwiſſon and Oerhne: barytes, potaſh, ſoda, lime, magneſia, ammoniac, zink, mangane ſe, iron, lead, tin, cobalt, copper, nickel, biſmuth, ſilver, alumines.

Alcohol digeſted over ants, extracts from them a little volatile oil, which, with that fluid, forms Hoffman's *ſpirit of magnanimity*. By firſt boiling theſe inſects in water, and then ſqueezing them, a fixed oil is obtained in the proportion of thirteen drachms to the pound. This oil is of a greeniſh yellow colour: it congeals ſooner than oil of olives, and is much like wax. The water of the decoction affords, by evaporation, a reddiſh brown extract, of a fetid ſmell, acidulous and caſeous, of a bitter taſte, nauſeous and acid. This extract is ſeparable into two ſubſtances, by the ſucceſſive application of water and alcohol. The parenchyma of ants ſeparated from theſe ſubſtances, amounts to three ounces two drachms, in the pound.

§ XI. *Of Wood-Lice.*

WOOD-LICE, *millepedes, aſelli, porcelli, oniſci, &c.* exhibited to M. Thouvenel, when he analyſed them, ſome properties peculiar to themſelves. When diſtilled without addition, in a water-bath, they afforded an inſipid alkaline phlegm, which ſometimes produced an effervefcence with acids, and turned ſyrup of violets green. They loſt in this operation five eights of their weight. When treated, afterwards, with water and alcohol, they afforded two drachms of ſoluble matter in the ounce; and of theſe more than two-thirds was extractive matter, and the reſt an oily or wax-like ſubſtance. Theſe two products are eaſily ſeparable by æther, which diſſolves the latter, without affecting the former. Theſe matters differ from thoſe of cantharides and ants, in affording more ammoniacal carbonate, and no acid, when diſtilled. M. Thouvenel obſerves, on this ſubject, that among inſects, wood-lice ſeem to bear the ſame relation to cantharides and ants, as oviparous quadrupeds and ſerpents bear to viviparous or real quadrupeds.

As to the neutral ſalts contained in theſe inſects, their quantity is exceedingly ſmall, and it is no eaſy matter to extract them. M. Thouvenel aſſerts, that wood-lice and earth-worms, *lumbrici*, always afforded him calcareous muriate, and muriate of potaſh; whereas, in ants and cantharides, theſe two baſes, of which the firſt always appeared to be the moſt copious, were always combined with an acid poſſeſſing the ſame properties as the phoſphoric acid. It is to be obſerved, that this chemiſt has not explained, in his diſſertation, the methods by which he extracted thoſe ſalts, or the proceſſes by which he aſcertained their nature.

Only cantharides and wood-lice are made uſe of in medicine. Wood-lice appear to act only as gentle ſtimulants and diuretics; and, according to M. Thouvenel's experiments, ſhould be given in ſtill ſtronger dozes than are commonly preſcribed of them. The juice expreſſed from forty or fifty living wood-lice, in a mild drink, or mixed with the juice of ſome aperient plants, may be given, with happy effects in the jaundice, ſerous diſorders, *à ſeroſa colluvie*, and coagulations of the milk, &c. Cantharides is one of the moſt potent of all medicines. M. Thouvenel himſelf had experience of the effects of the green waxen matter in which the virtues of theſe inſects ſeem to reſide: nine grains of it laid on the ſkin, raiſed a bliſter, full of ſerous matter, in the ſame manner as powder of cantharides. But what is moſt particularly worthy of notice of all the facts reſpecting the virtues of this powerful remedy, is, that the ſpiritous tincture of cantharides may be applied, with the happieſt ſucceſs, externally, in dozes of from two drachms to two ounces and an half, in rheumatic and ſciatic pains, and in the wandering gout. It heats the ſkin, quickens circulation, and occaſions evacuation, by ſweat, urine, and ſtool, according as it is applied on this or that part. Young phyſicians are to be cautioned againſt adminiſtering this medicine too raſhly internally: It has been known to occaſion fluſhings on the ſkin, ſpitting of blood, pains in the loins and bladder, dyſuries, &c.

§ XII. *Of Honey and Wax.*

The honey and wax prepared by bees, appear to belong to the vegetable kingdom; for theſe inſects collect the one of theſe ſubſtances from the nectaria of flowers, the other from the antheræ of their ſtamina. But they are elaborated in a particular manner: and beſides, as they are the work of bees, their properties come moſt naturally to be examined in the hiſtory of theſe inſects.

Honey is a matter perfectly like the ſaccharine juices which we have examined as belonging to vegetables. Its colour is white or yellowiſh; its conſiſtency ſometimes ſyrupous, often ſoft and granulated, and its taſte ſaccharine and aromatic. By alcohol, and even by water, with a little trouble, a real ſugar may be obtained from honey. It affords in the retort, an acid phlegm, and an oil; and its reſidual coal is ſpongy and porous, like that of the mucilages of plants. The nitric acid converts honey, as well as ſugar, into oxalic acid. It diſſolves very eaſily in water: it forms a ſyrup, and paſſes, like ſugar, into a ſtate of ſpiritous fermentation. It is a very agreeable article of food, and a ſoftening, and ſlightly aperient medicine. Diſſolved in water, and mixed with vinegar, under the name of oxymel;—it is frequently combined with ſome acrid plants, as in oxymel of ſquills, and of colchicus. It is the vehicle for many medicines which bear its name, ſuch as honey of roſes, honey of water-lily, mercurial honey, &c.

Wax is a concrete, oily juice, reſembling ſolid fixed oils, ſuch as butter of cacao, and ſtill more vegetable wax. Although there can be no doubt that this ſubſtance is collected from the ſtamina of flowers, yet it is no leſs certain, that it undergoes ſome particular elaboration in the body of the animal; for Reaumur found it impoſſible to form flexible wax of the powder of flowers. The wax which compoſes the honey-combs of bees is yellow, and of an inſipid taſte. The action of the dew and the atmoſphere whitens it, when expoſed to it in thin plates: the oxigenated muriatic acid whitens it very ſpeedily. It becomes ſoft by a gentle heat, melts, and forms a tranſparent oily fluid: by cooling, it becomes ſolid and opaque. When heated in contact with air, it kindles as ſoon as it becomes volatile: and this is the effect of the wick in candles. When diſtilled in a retort, it affords ſebacic acid, and an oil which is at firſt fluid, but afterwards fixes in the receiver, and takes the conſiſtency of butter. The quantity of the coal remaining is very trifling, and it is very difficult to incinerate. The butter of wax, after being ſeveral times rectified, becomes fluid and volatile.

White wax is not liable to be altered by the air: it acquires a colour in the courſe of a certain time. It diſſolves in oils, giving them conſiſtency. When melted with theſe fluids by a gentle heat, it forms the medicines called *cerates*. Alcohol does not act upon wax. Acids blacken it: alkalis combine with it; and thus reduce it to a ſaponaceous ſtate.

Wax is uſed in many of the arts; and in pharmacy, in the preparation of pomatum, ointments, and plaſters.

§ XIII. *Of Silk Worms, the Bombic Acid, and Silk.*

The ſilk-worm, eſpecially in a chryſalis ſtate, contains an acid liquor in a cell near the anus. M. Chauſſier, of the academy of Dijon, obtained this acid both by ſqueezing the juice of the cryſalis through a cloth and precipitating the mucilage with alcohol, and by infuſing the cryſalis in alcohol. When the acid is ſeparated by alcohol, it carries it with it through the filter; and there remains on the paper an orange-coloured fat oil, a gummy matter, and a little gluten. To obtain the bombic acid in a ſtate of purity, the alcohol muſt be diſtilled: on that occaſion the alcohol is volatilized, and the acid only remains in the retort. The acid is very pungent, and of an amber yellow colour: its nature and combinations are unknown.

Many other inſects likewiſe contain acid. It has been remarked by M. Bonnet, that the large caterpillar of the willow emits a liquor of conſiderable acidity. I have often obſerved the bupreſtes and ſtaphylini to communicate a red colour to the blue paper with which boxes containing them were lined. M. Chauſſier has likewiſe obtained an acid from the graſshopper, the red bug, and the lampyris, or glow-worm.

Silk appears to be only a ſort of dried gummy matter. It differs from vegetable ſubſtances, 1. In affording ammoniac by diſtillation: 2. In affording gas azote with nitric acid: 3. In affording a peculiar oil, which is ſeparated from it when the nitric converts it into oxalic acid, as has been ſhewn by M. Berthollet. It ſeems to be a compound, conſiſting of a vegetable mucilage, with a peculiar animal oil, which renders it pliable, ductile, and elaſtic.

§ XIV. *Of Reſin Lac.*

The name of *gum lac* has been improperly given to a dark, red reſinous ſubſtance, depoſited on the branches of trees by a ſpecies of ants peculiar to the Eaſt Indies. This ſubſtance appeared to Geoffroy to be a ort of nidus in which thoſe ants depoſited their eggs. n fact, ſtick lac, when broken, appears full of ſmall, egular cavities, or cells, containing ſmall oblong bodies, which Geoffroy conſidered as embryon ants. He thought he colour of the lac owing to this animal matter. The lac he conſidered as a real wax: yet, its dryneſs, the aromatic ſmell which it exhales when burning, and its ſolubility in alcohol, render it more like reſin than wax. According to the ſame writer, it affords a ſort of butter y diſtillation. It is at preſent aſcertained, that the lac formed by a ſpecies of the coccus, and depoſited on e branches of a ſpecies of the *croton;* which is named that account *croton lacciferum.*—In commerce, ſtick lac, grain lac, and ſhell lac, are diſtinguiſhed from each other. It is to be obſerved, that many other colouring ſubſtances, particularly red animal or vegetable fæcula, when prepared in a particular manner for dyeing, are called *lac.* In the Levant, lac reſin is uſed in dyeing cloth and ſkins. It is the baſis of ſealing-wax. A tincture is formed from it with ſpirit of cochlearia. It enters into troches of amber, dentifrice powders, and opiates, odorous paſtills, &c.

§ IV. *Of Kermes.*

Kermes, or chermes, *coccus infectorius,* was formerly conſidered, by naturaliſts, as a tubercle or excreſcence from plants. More accurate obſervation has ſince ſhewn it to be the female of an inſect, which Geoffroy rank among the hemiptera. The female inſect fixes on th leaves of the holm-oak: after being fecundated, it extends itſelf, dies, and in a ſhort time loſes the inſec form. It has the appearance of a brown cap, incloſin a great many eggs. This cap was formerly uſed in dyeing; cochineal now ſupplies its place. Kermes exhibi the ſame chemical properties with the cochineal. It enters into the confectio alkermes, &c.

§ XVI. *Of Cochineal.*

Cochineal, like kermes, was long conſidered as vegetable grain. Father Plumier was among the fi who diſcovered this to be a miſtake. In fact, this ſu ſtance is the female of an hemipterous inſect, whi differs from the kermes in retaining its form after fixi on plants. The cochineal uſed in dyeing grows on the opuntia, or Indian fig-tree. It is collected in great quantities in South America. Geoffroy, who analyſed it, found it to contain the ſame principles with kermes, and obtained ammoniac from it. The form of the inſect may be diſtinguiſhed after macerating it in water.—Cochineal is uſed in making carmine and in dyeing. It affords either a crimſon or a ſcarlet colour, according as it is uſed. Being an extractive colouring matter, it cannot be applied to ſubſtances intended to be dyed, without a corroſive. It fixes eaſily on wool, and communicates to it a ſcarlet dye, by means of a ſolution of tin in muriatic acid, which decompoſes the colouring extract, nd contributes greatly to the brilliancy of the tinge. Macquer firſt taught to communicate this beautiful colour to ſilk. That celebrated chemiſt diſcovered a method of fixing the dye on this ſubſtance, by impregnating the ſilk with the ſolution of tin, before immerſing it nto the cochineal bath, inſtead of mixing the ſolution ith the bath, as is done in dyeing wool.

§ XVII. *Of Crab's Stones.*

THE ſtony concretion, improperly called *crab's eyes*, *pides cancrorum*, are found in pairs, in the interior and ower part of the ſtomach of theſe cruſtaceous inſects. They are round, convex on one ſide, concave on the other, and diſpoſed between the two membranes of the entricle of the animal. As they are found only at the me when the crab changes its ſkin and ſtomach, and e gradually deſtroyed as the new covering of the inſect gains conſiſtency, it has been thought, with great appearance of probability, that they contribute to the reproduction of the calcareous ſubſtance which forms the baſe of the ſhell of the animal.

Theſe ſtones have no taſte: they contain a ſmall quantity of gelatinous matter. They are prepared for uſe, by waſhing them ſeveral times, and levigating them with a little water, to reduce them to a ſoft paſte; which is wrought into little balls, and then dried. As the water with which theſe ſtones are waſhed takes up the gelatinous matter, what remains is nothing but an earthy ſubſtance. When prepared in this manner, they produce a lively effervescence with all acids, and are preciſely of the ſame nature with chalk. Their only virtue is that of abſorbing acid matters in the primary paſſages. That opinion which ranks this ſubſtance among aperient, diuretic, and cordial medicines, is equally ill-founded with many other fanciful opinions which have been entertained concerning the virtues of animal ſubſtances.

§ XVIII. *Of Coral.*

Precisely of the ſame nature is coral,—a ſort of calcareous ramification, either white, roſe-coloured, or red, which forms the baſis of the habitation of the ſea polypi. It is prepared in the ſame manner as crab's ſtones. Like thoſe lapideous ſubſtances, it is of a calcareous nature. It enters into the confectio alkermes pulvis gutteti, and amber troches. Numberleſs virtues have been aſcribed to it; but unleſs combined with acids, it poſſeſſes no virtues, ſave thoſe of a mere abſorbent. Like crab's ſtones, it is often uſed, in a neutra

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ſtate, with vinegar, or lemon-juice, as an aperient, a diuretic, &c.

§ XIX. *Of the true Coralline.*

THE coralline, called *ſea-moſs*, is, as has been ſaid, a peculiar habitation of polypi. In the retort it affords the ſame principles as animal colours: its taſte is ſaltiſh, bitter, and diſagreeable. It is uſed as a vermifuge, with good effects. To children it is given in a powder, in doſes of four and twenty grains,—and to adults in doſes of two drachms or more: an anthelmintic ſyrup is prepared with it: it enters into worm-powders. This common coralline muſt not be confounded with that which is at preſent called *coralline of Corſica, lemitho, or helmintocorton:* this laſt is a vegetable ſubſtance, a ſort of fungus which forms a jelly with hot water.

CHAP. XV.

General Reſult of the Analyſis of Animal Subſtance Compariſon of Animal Subſtances with Vegetable Matters.

IN the fourteen preceding chapters, we have given the hiſtory of the preſent ſtate of chemical knowledge with reſpect to animal ſubſtances. Thoſe who have cultivated chemiſtry during the laſt twenty years will eaſily diſtinguiſh what the ſcience has gained in this branch in the courſe of that period, and what amazing progreſ it has here made. Although many experiments ſtill remain to be performed, and many diſcoveries to be made in order to complete the hiſtory of animal matters; ye our preſent knowledge of them is much more conſiderable than what was formerly poſſeſſed: the proper road is, at leaſt diſcovered; and we need no longer be afrai of wandering in a wrong direction. It now appear plainly how much the phyſics of animal nature may be improved by chemiſtry, and what important ſervice medicine may expect from it, when the two ſcience proceed hand in hand. If, after what is contained i the foregoing chapters, this aſſertion can be thought t need any additional proofs, theſe will be found in th following ſhort recapitulation.

The matters which are called immediate principles of organic ſubſtances; that is to ſay, ſuch matters as are ſeparated from organized bodies, directly, and without alteration; bear a ſtrong analogy to thoſe which are extracted from vegetables. We find in animals, as well as in vegetables, extracts, a ſaccharine principle, inſipid mucilages, acid and alkaline ſalts, fixed and volatile oils, reſins, glutinous matter, an aromatic principle, and colouring ſubſtances. But notwithſtanding this analogy, which was long ago obſerved, there are ſome remarkable differences between theſe immediate principles of the two kingdoms, the examination of which it is of ſufficient importance to engage the attention of philoſophers.

1. The extract and the ſaccharine matter, are not near ſo copious in animal as in vegetable matters.

2. The mucilages of animal are ſomewhat different from thoſe of vegetable bodies: they are ſofter, eaſier dried, and capable of attracting moiſture from the atmoſphere; they form into a jelly by cooling; their taſte is ſtronger, too, and they become ſour, and putrefy much ſooner.

3. The fixed oils of the animal kingdom are alſo different from thoſe of vegetables. They are found in certain cells, in much larger quantities: they are always more or leſs concrete, and often ſuſceptible of deſiccation and cryſtalliſation.

4. Volatile oils and reſins are in general much leſs copious among animals than among vegetables. It would appear, that nature has carefully removed from the ſenſible and irritable organs of animals thoſe acrid ſubſtances which would have conſtantly ſtimulated the fibres:

bres.: even in vegetables, they are diſpoſed near the exterior tunics.

5. Albuminous matter, liable to concretion by heat, though to be found among the juices of vegetables, is leſs copious in them than in animals, all whoſe parts generally contain a conſiderable quantity of it.

6. The ſubſtance of the fibres of animals, though ſomewhat ſimilar to the gluten of flour, is however more tenacious and elaſtic; and beſides, its proportion is ſo conſiderable, that were there no other difference between animals and vegetables, this alone might well engage the attention, and employ the induſtry of phyſiologiſts. All the muſcles or organs of motion are compoſed of it; and as animals diſplay loco-motive powers which are not obſerved in vegetables, the parts in which thoſe loco-motive powers reſide, muſt be eſſentially different from the motionleſs bodies of plants.

7. But animal differ ſtill more from vegetable matters, in the nature of the ſaline ſubſtances which they contain. Beſide the ſalts and radical principles of ſaline bodies in animal matters, of the ſame nature with thoſe which vegetables contain, ſuch as lime, ſoda, the muriatic, oxalic, malic, benzoic, ſebacic, and phoſphoric acids: they afford alſo the lactic, ſaccholactic, lithic, formic, and bombic acids, whoſe nature is not known, but which do not appear to exiſt in vegetables. In animals, too, the principles from which ammoniac and the pruſſic acid are formed, exiſt in greater abundance than in vegetables; and this is what moſt eminently diſtinguiſhes animal from vegetable matters. The principles requiſite to the formation of ammoniac and the pruſſic acid, azote, hydrogene, and

carbone, are even ſo copious in animal ſubſtances, that theſe compounds are very often ready formed, eſpecially in animals a ſhort time after death. I have found Pruſſian blue in putrid animal matters. I have even ſeen the blood of a ſick perſon, which was very much altered, aſſume a bright blue colour, on expoſure to the air. But it muſt be acknowledged, that vegetables likewiſe contain the principles of the pruſſic acid, though not in ſo great abundance. As to ammoniac, its being formed much eaſier, and much more frequently in animal matters than in vegetables, ſhows that the former contain its principles in much greater abundance than the latter: And in fact, M. Berthollet has proved, that thoſe matters afford a much greater quantity of gas azote than the others, with the nitric acid. I have alſo proved, that after the gas azote is extracted from animal ſubſtances, they no longer afford ammoniac. It is therefore to this principle hey owe their property of affording, either by a naural or an artificial analyſis, a great quantity of this lkaline ſalt.

If we enquire, then, what are the more ſimple primary principles of which thoſe immediate principles re compoſed; it will be found, that the only comonent principles of animal matters, as well as of veetable ſubſtances, are, hydrogene, carbone, azote, nd oxigene. Theſe bodies, which, as they have not et been decompoſed, may be ſaid to be in ſome meaure elementary, appear to conſtitute, by various cominations with one another, oils, acids, mucilages, the brous part, &c. Theſe more immediate principles, gain, differ from each other only in the number and

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the proportions in which the primary ſubſtances are combined in them. But, as animal matters, though conſiſting in general of the ſame principles with vegetable ſubſtances, are however really different in their properties; the difference muſt be owing to their containing the primary principles in different proportions. The ſuperior proportion in which animal matters contain the principle of azote, accounts for a great many of thoſe differences: it explains why animal ſubſtances afford a great deal of ammoniac by the action of fire; why they putrefy ſo ſoon; why they are neceſſary to the production of acid of nitre, &c.—The only thing which now remains to be enquired into, is, What change vegetable matters undergo, when they paſs into animal bodies? For it is certain, that none but vegetable matters are proper for the nouriſhment of animals, or convertible into animal ſubſtance. It is firſt to be obſerved, that many of the immediate principles of vegetables paſs unaltered into the bodies of animals, ſtill retaining their peculiar nature,—or at leaſt ſuffer but very little alteration; ſuch, particularly, are various ſalts, fixed oils, &c. But the different ſorts of mucilage, the gluten, and colouring ſubſtances, manifeſtly undergo a change of nature: the gummy matter becomes gelatinous, and the gluten is converted into th fibrous part; the baſe of azotic gas, or azote, become fixed in thoſe ſubſtances, and combines with them in large proportion: and the fixation of this princip ſeems to convert vegetable into animal matter. Thi change, and the formation of the different animal ſubſtances, ſhould chiefly engage the attention of phyſiologiſts: this, in ſhort, is the great problem with regar to animal nature which remains to be ſolved. Analyſis has already ſupplied ſome valuable facts towards this ſolution; but many more are ſtill wanting: and it is only by accurate chemical proceſſes, that we can hope to obtain a ſufficient number for the accompliſhment of ſo deſirable a purpoſe.

CHAP. XVI.

Of the Putrefaction of Animal Subſtances.

VEGETABLE matters, though liable to be decompoſed, and even entirely deſtroyed by putrid fermentation, are, however, far from being ſo liable to that inteſtine emotion as animal matters. The putrefaction of theſe laſt matters is much more rapid than that of the others, and exhibits very different phenomena. All the fluids, and all the ſoft parts of animals, are alike ſubject to it; but many vegetable matters ſeem to be entirely ſecure from it,—or, at leaſt, it takes place on them very ſlowly, and with very great difficulty.

The putrefaction of animals, which one cannot help conſidering, with Boerhaave, as a real fermentation, is one of the moſt important phenomena in nature, and, at the ſame time, very difficult to underſtand. All the reſearches of philoſophers, from the days of Lord Bacon of Verulam, who ſaw its importance, to the preſent time, have explained only a few circumſtances, and examined only the general phenomena of putrefying matters. Beccher, Hales, Stahl, Pringle, Macbride, Gaber, Baumé, the reſpectable Author of the Eſſays on Putrefaction, and the Authors of the Diſſertations on Antiſeptics, which obtained prizes from the Academy of Dijon in the year 1767, have obſerved the phenomena which attend the putrid alteration of ſubſtances and deſcribed them with ſufficient care. But, from the account which we are about to give of what is known concerning this matter, it will appear, that a great number of future experiments are neceſſary, to make us acquainted with all the particulars of what paſſes in this operation of nature.

Every fluid, or ſoft extract of an animal body, when expoſed to the temperature of ſixty-five degrees, or ſomewhat more, undergoes, with more or leſs rapidity, the following alterations: Its colour becomes pale, its conſiſtency is relaxed; If a ſolid part, ſuch as fleſh, it becomes ſoft, and exſudes a ſerous matter, the colour of which is very ſoon altered; its organization is deſtroyed; its ſmell becomes inſipid and diſagreeable; by degrees, this altered ſubſtance decreaſes in bulk, and its ſmell becomes ammoniacal. After this, if it be preſerved in a cloſe veſſel, the putrefaction appears to proceed more ſlowly; none but an alkaline, pungent ſmell is felt from it:—the matter effervеſces with acids, and turns the ſyrup of violets green. But, when air is admitted, the urinous exhalation goes off, and a peculiar, inſufferable putrid ſmell riſes from it with a degree of impetuoſity: this ſmell continues for a long time, penetrates every where, and ſeems to affect the bodies of animals, like a fermenting ſubſtance capable of altering their fluids. This ſmell is corrected, and in ſome meaſure confined, by the ammoniac. After the volatilization of the ammoniac, the putrefaction proceeds with new energy: the putrefying maſs ſuddenly ſwells, and appears filled with bubbles of an elaſtic fluid; but ſoon ſhrinks a-new: its colour is altered, and the fibrous texture of the fleſh is now ſcarce diſtinguiſhable: it is changed into a ſoft matter, of the conſiſtency of a poultice, and either brown or greeniſh: its ſmell is inſipid and nauſeous, but acts with great energy on animal bodies. This odorous principle by degrees loſes its ſtrength: the fluid part of the fleſh becomes, in ſome meaſure, conſiſtent: its colour becomes deeper; and it is at laſt reduced to a friable matter, half-dry, yet ſomewhat deliqueſcent; which, by friction with the finger, breaks into a coarſe powder, like earth. This is the laſt ſtate that has been obſerved of the putrefaction of animal ſubſtances; they take a conſiderable time to reach this point, which is, however, ſometimes longer, ſometimes ſhorter. Eighteen months, nay two or even three years are ſcarce ſufficient for the compleat deſtruction of the whole texture of an animal body expoſed to the air; and the length of time which paſſes before the entire deſtruction of carcaſes buried in the ground, has not been yet aſcertained. Not to ſpeak of bodies which become dry in certain ſoils, and remain without ſuffering farther alteration,—many facts prove, that dead bodies buried together in great numbers in moiſt earth, are not deſtroyed even in the ſpace of 30 years.

From theſe particulars, it follows, 1. That the circumſtances neceſſary to excite and carry on the putrefaction of animal ſubſtances, are, the contact of air, heat, moiſture, and reſt or inactivity;—maſſes of animal matter, in order to putrefy, muſt be ſubject to all theſe circumſtances: 2. That ammoniac is one of the products of putrefaction, and is formed during the fermentation; as it did not before exiſt ready-formed in thoſe ſubſtances: 3. That the putrefaction, accompliſhed by an internal motion peculiar to organized bodies, may be compared to the action of fire, as has been remarked by M. Goddard; and conſidered as a ſpontaneous decompoſition, as thinks M. Beaumé; differing from that action only in taking place more ſlowly: 4. That in this natural operation, the proximate principles of animals react on each other with the help of water and heat, which firſt excite the emotion; and accordingly, the newly-formed volatile matters are, by degrees, diſſipated, in the order of their volatility, till nothing is left at the end of the putrefaction, but an inſipid, and ſeemingly earthy reſidue: 5. That the putrid exhalation, the character of which is ſo well diſtinguiſhed by the olfactory nerves, and which acts with ſuch energy on the animal œconomy, is to be conſidered as one of the principal products of putrefaction, ſince it is peculiar to this operation, and not obſerved in any other natural phenomenon; and ſince, beſides, it appears capable of exciting a putrefactive emotion in all other animal ſubſtances expoſed to its action. As to the nature of this fugitive odorous ſubſtance; it is particularly on this point that our reſearches have made but ſmall progreſs, and ſhould be farther proſecuted. What we know of it, proves it to be extremely volatile, ſubtle, and penetrating in its nature; and that pure air, water in a large proportion, and acid gaſes are capable of moderating its effects. Although it muſt not be confounded with carbonic acid gas, a great deal of which is diſengaged from putrefying bodies, and to the diſengagement of which alone Macbride aſcribed the cauſe of this natural phenomenon; and although it muſt not be conſidered as reſembling either the hydrogenous gas which is diſengaged from putrefying bodies, or the luminous matter which ſparkles on the ſurface of putrid animal fibres, and renders them phoſphoric; yet it cannot be denied, that there ſubſiſt between it and thoſe ſubſtances ſome pretty ſtrong relations, as it invariably accompanies them, is equally ſubtle and volatile, and acts with the ſame energy on the organs of animals.

We may obſerve, with M. de Boiſſieu, that there are four different degrees in the putrid fermentation of animal ſubſtances.

The firſt, which that philoſopher calls *tendency to putrefaction*, conſiſts in a ſlight alteration, which appears to take place by the diffuſion of a ſort of muſty ſmell, and the ſoftening of the ſubſtances.

The ſecond degree, that of *putrefaction commencing*, is ſometimes indicated by marks of acidity. Matters in this degree of putrefaction, loſe a part of their weight, become ſoft, and give out ſerous matter, if in cloſe veſſels; but, if expoſed to the open air, they rather become dry and dark-coloured.

In the third degree, that in which *putrefaction has made ſome progreſs*, the putreſcent matters exhale an ammoniacal ſmell, mixed with a putrid and nauſeous ſmell: they are then diſſolved, and their colour more and more altered; and they at the ſame time ſuffer a loſs of weight, and decreaſe in bulk.

Laſtly, the fourth degree, that in which *putrefaction appears compleated*, is diſtinguiſhed by the ammoniac's being now entirely diſſipated, and no trace of it remaining: the fetid ſmell is now fainter, and the weight and bulk of the putrefied ſubſtances are conſiderably diminiſhed: a gelatinous mucous matter is ſeparated from them; they become gradually dry, and are at laſt reduced to a friable earthy matter.

Such are the general phenomena obſervable in the utrefaction of animal ſubſtances; but they are far from aking place uniformly in all inſtances of the putrefacion of animal ſubſtances. In the firſt place, there is a ide diſtinction between the manner in which parts of he living bodies of animals putrefy, and that in which his change takes place on dead carcaſes. In the forner, the vital functions modify the phenomena of this lteration in a particular manner: phyſicians have freuently occaſion to obſerve the differences between heſe two ſtates of animal bodies, in reſpect to putrefacon. Beſides, every different humour, every different lid part in an animal body putrefies in a peculiar maner. The muſcular, membranous or parenchymatous xture of the organs,—the oily, mucilaginous or lymhatic nature of the humours,—their conſiſtency,—their ate with reſpect to that of the animal to which they long,—all influence the emotion of putrefaction, and dify it in a thouſand different ways, which it would rhaps be impoſſible to diſcriminate. Laſtly, the ſtate the air, its temperature, its elaſticity, its weight, its yneſs or moiſture, the particular local ſituation of the trefying ſubſtance, and the very form of the veſſel in hich it is contained, are all likewiſe to be taken into count; for all theſe circumſtances contribute to diverthe phenomena of this ſpontaneous decompoſition bodies. It muſt therefore be acknowledged, that we not yet acquainted with more than the outlines of hiſtory of the putrefaction of animal ſubſtances; and that, to fill theſe up, a long ſeries of reſearches and experiments is requiſite.

Thoſe phenomena of putrefaction which *have* been obſerved, ſhew that it is owing originally to water: moſt probably, that fluid is decompoſed; and its oxigene combining with the azote of the animal ſubſtances, thereby produces the nitric acid which they are ſo frequently found to contain; and its hydrogene, again, may unite with another part of the azote, which is very copious in thoſe matters, to form the ammoniac that is diſengaged. The oily principle is ſeparated, and remains longeſt unaltered. The calcareous phoſphate, and phoſphate of ſoda, in union with a portion of pure carbonaceous matter, and perhaps a little fat matter, ſeem to compoſe the apparently earthy reſidue of putrefied animal matters.

We have as yet deſcribed only the phenomena which take place on animal matters, when they are decompoſed by putrefaction in the open air. As the phenomena of that decompoſition in different media, tend to illuſtrate the revolutions which take place on our globe, let us conſider, for a little, what happens to thoſe matters, when they putrefy in water, or under ground.

The changes which take place in water are not quite the ſame with thoſe above deſcribed. Animal bodies immerſed in that fluid, firſt ſwell: elaſtic fluids are next diſengaged from them: the water diſſolves a great part of their principles, decompoſes another part, and diſperſes thoſe conſtituent principles over large maſſes of water: accordingly, ſome nations have expoſed their dead carcaſes in rivers, and truſted to the waters for their deſtruction.

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Different phenomena take place when animal bodies are buried under ground. Obſervations, moſt of which were accidentally made, have ſhewn, that they are more rapidly or more ſlowly deſtroyed, according to the nature of the ſoil. Bodies are ſometimes found to be totally deſtroyed in a little time; and ſometimes they are found in a good ſtate of preſervation, even after lying a long time under ground. It may be eaſily conceived, that where the earth is very porous and light, and the animal matter diſpoſed near the ſurface, air, and eſpecially water, will then obtain eaſy acceſs, and contribute to its decompoſition. In oppoſite circumſtances, the decompoſition muſt naturally be much ſlower. Dry earth, for inſtance, abſorbs water from bodies, renders them dry, and converts them into mummies. A ſandy ſoil, in which bodies are expoſed to the impreſſion of a ſcorching ſun, produces a ſimilar effect, giving them a degree of hardneſs which renders them ſecure againſt deſtruction for ages. Argillaceous earth, again, retains water, and therefore favours the putrefaction of bodies. In caſes in which it takes place, either ſooner or latter, the fluids and ſolids are at laſt reduced almoſt entirely into gas azote, carbonic acid gas, hydrogenous gas, and ammoniac gas. All theſe elaſtic fluids, as they filtrate through the earth, are in part ſtopped in their progreſs, and rendered fixed; and accordingly render the mould black, fat, and fetid. Theſe products of putrefaction ſaturate the mould in ſome meaſure, till they are at length carried off by the diſſolving action of water and air, evaporation by heat, and abſorption by vegetables. Thus, nature, by a ſlow decompoſition, reduces animal bodies, after they are deprived of life, into more ſimple ſubſtances, fitted to enter into new combinations.

This decompoſition conſidered, as it takes place, all over the globe, at once, on the earth, in the air, and in water, gives riſe to ſome important changes in nature, which philoſophers ſhould obſerve and aſcertain. When we obſerve the wide extent of the ſea, and the immenſe number of animals by which it is inhabited, it appears, that vaſt quantities of animals periſh in it, which, by their ſpontaneous decompoſition, muſt give riſe to a number of phenomena that have been, as yet, but too little examined. What becomes of all thoſe remains of animal bodies? What ſucceſſive revolutions do they undergo? Sea-water is known to contain muriate and ſulphate of ſoda, lime, and magneſia: No doubt, muriatic acid, magneſia, lime, and ſoda, are continually forming in this laboratory; nay, perhaps, the formation of many of theſe ſubſtances may be carried on by marine animals, during their lives; but others can be owing only to the decompoſition of the ſame animals after death. It cannot be denied, that the ſtrata of calcareous matters, which compoſe, as it were, the ſhell or cruſt of our globe over a very conſiderable part of its ſurface, have been originally produced from the remains of ſkeletons of marine animals, more or leſs broken by the action of the waters; that thoſe ſtrata have been primarily depoſited at the bottom of the ſea; and that bitumen, and pit-coal which is depoſited in very thin and extenſive ſtrata, both of which ſubſtances occupy a part of the globe, have been originally produced in this manner. In the ſeas, therefore, there is a decompoſition

poſition of water conſtantly carried on: innumerable agents are ever ſeparating its principles, and ſuffering alterations themſelves. Immenſe maſſes of chalk, from time to time depoſited on the bottom, abſorb and fix, that is, convert into ſolid ſubſtance a part of the liquid with which that capacious reſervoir is conſtantly filled.

From theſe reflections on the decompoſition of animal ſubſtances, in the earth, the air, and the waters, with all the aſſemblage of facts which chemiſtry ſupplies concerning it; it follows, that the exterior ſtrata of the globe are now different from what they originally were: that it is increaſing in ſolidity and extent by the ſucceſſive and uninterupted accumulation of calcareous matter from the deſtruction of animal bodies: that the ſoil of the earth which we inhabit is modern and factitious: that minerals are not to be conſidered as forming a part of this ſoil: that it has been produced from a ſlow decompoſition of animal and vegetable bodies: that water is conſtantly diminiſhing in quantity, and aſſuming a new form: that one part of decompoſed water forms one of the baſes of animal and vegetable bodies: that another part enters, in a ſolid form, into the calcareous ſtrata of the globe: that the atmoſphere muſt have been influenced and modified by all thoſe changes: that vegetables are continually influencing the ſtate of atmoſpheric air; and that the light of the ſun acts an important part in the production of theſe mutual alterations. Although it may appear impoſſible to determine the length of time in which the decompoſition of water, vegetation, fermentation, putrefaction, the formation of ſaline matters, bitumens, and calcareous ſubſtances, and their modifications, have been ſucceſſively carried on; yet the modern diſcoveries with which chemiſtry and natural philoſophy have been enriched, ſhew, that thoſe phenomena have taken place at different periods; that they continue to modify the preſent ſtate of our planet: And that, if matter be, as great philoſophers aſſert, only one ſubſtance, as to its maſs and intimate nature; yet its form is continually varying by new combinations, and gradually experiencing great revolutions; of which modern chemiſtry, and modern chemiſtry alone, can aſcertain the cauſe, and may one day determine the ultimate effects.

CONTINUATION

Of the ANIMAL KINGDOM.

Of the Methodical Claſſification and the Natural Hiſtory of Animals.

AS the inferior animals on our globe are ſo numerous, it would be impoſſible for mankind to diſtinguiſh them from one another, or gain any conſiderable knowledge of their nature and habits, if they did not exhibit remarkable differences, which render it eaſy to eſtabliſh diſtinctions among them. Naturaliſts have always been ſenſible of the utility of thoſe differences; and by dividing animals according to them, either into more or fewer claſſes, have happily formed what are called *methods.* Though it be certain that no ſuch claſſifications exiſt in nature, and all the individuals which ſhe has produced, form one continued, uninterrupted ſeries; yet they muſt be acknowledged to aſſiſt the memory, and to form truly uſeful guides in the ſtudy of natural hiſtory. Methods are therefore to be conſidered as inſtruments ſuited to our weakneſs, which may be happily made uſe of in tracing the wide field over which the ſtores of nature are ſtrewed. The diviſions which Ariſtotle eſtabliſhed, were very general and ſimple; but his ingenious reflections on the internal and external organs of animals, formed the baſis on which moſt of the firſt naturaliſts who attempted methodical diviſions—ſuch as Aldrovandus, Johnſton, Charleton, Ray, &c. eſtabliſhed them. Thoſe naturaliſts have been ſucceeded by a number of others, by whom their methods have been improved, and much added to the knowledge which they had collected. Among the latter, thoſe whoſe works are the moſt worthy of being ſtudied, and from which what follows here on this ſubject is borrowed, are Meſſrs Klein, Arthedi, Briſſon, Daubenton, Geoffroy, &c.

After man, the organization of whoſe body, and the intelligence with which he is endowed, entitle him to be ranked at the head of all the animals inhabiting our globe, in a ſeparate claſs,—all the other animals may be arranged in eight claſſes:—Quadrupeds, Cetaceous Animals, Birds, Oviparous Quadrupeds, Serpents, Fiſhes, Inſects, and Worms, with which may be aſſociated Polypi.

Theſe claſſes might perhaps be rendered much more numerous. But, with the diviſions, the difficulties of the ſtudy would be increaſed: and this is to be carefully avoided, in an artificial method; as ſuch a method muſt owe all its value to ſimplicity and perſpicuity. M. Daubenton, who has laboured much on the claſſification of animals, has arranged them in the ſame manner; and, under each claſs, has conſidered the ſtructure of the principal parts of the animals contained in it; ſhewing, that from man to the worm, animals become gradually more imperfect in their organization. (*See Table I. at the end of this volume.*)

In the hiſtory of animals, there are two principal objects of attention: 1. Their external forms, and the methods founded on thoſe forms: 2. Their internal organs, and the functions for the performance of which they are deſtined. Theſe two diſtinct objects we ſhall conſider in two ſeparate Sections.

SECTION I.

A Sketch of the different Methods of the Natural Hiſtory of Animals.

ARTICLE FIRST.

Of Quadrupeds. ZOOLOGY.

QUADRUPEDS are animals with four feet, whoſe bodies are generally covered with hair. They reſpire by lungs, like the human ſpecies: they have alſo a heart, with two ventricles: they are viviparous. Their ſtructure, more than that of any other animals reſembles the ſtructure of the human body. Some o them, ſuch as the ape, and a few others, have eve been ranked by Linnæus in the ſame claſs with man That naturaliſt gives this claſs of animals the nam of *mammalia*,—comprehending, alſo, cetaceous animals, becauſe theſe, too, have breaſts, and ſuckle thei young.

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Although this claſs of animals may ſeem to be nearly of the ſame order with man; yet, between the two, there are ſome ſtriking differences, which we may here enumerate:—The horizontal diſpoſition of their bodies, the form of the extremities, the thickneſs, the ſtiffneſs of the ſkin—which is either covered with hair, or with a hard and corneous cruſt; the prolongation of the back-bone into a tail; the flat, horizontal form of the anterior part of the cranium, the length and breadth of the ears, the extreme length and oblique diſpoſition of the bones of the noſe and the upper jaw: the union of the fingers; the immobility of the bones of the fore-arm on one another;—theſe are all properties in which this claſs of animals differs from the human ſpecies. The diſpoſition of the human body, again, is elevated and perpendicular; the bone of the radius is moveable upon the ulna, the fingers are ſeparate, the thumb placed oppoſite to the other four, and the ſkin ſmooth and thin.—This difference of ſtructure muſt evidently improve the ſenſibility of human beings, and render them much ſuperior to the moſt perfect of the other animals. The anatomy of their internal organs, and the hiſtory of their functions, will corroborate ſtill farther theſe important conſiderations.

Ancient naturaliſts, at the head of whom are Ariſtotle and Pliny, did not think of diſtinguiſhing quadrupeds any other way but by the regions which they inhabited: Accordingly, ſuch is the inaccuracy of their deſcriptions, and ſuch the uncertainty of thoſe characteriſtics which they have pointed out, that we are often at a loſs to diſcover what animals they allude to. Naturaliſts, ſenſible of the inconveniences attending this method, have ſince adopted a very different mode, in their deſcriptions of the objects of natural hiſtory. From the exterior form of the moſt conſpicuous parts of animals, they have aſſumed characteriſtics eaſily diſcernible, and ſufficient to eſtabliſh certain diſtinctions. We ſhall here give an account of only three artificial methods of arranging quadrupeds: thoſe of Meſſrs Linnæus, Klein, and Briſſon.

The METHOD *of* LINNÆUS.

LINNÆUS divides animals with teats, *mammalia*, into ſeven orders. The firſt comprehends thoſe which he calls *primates*, the characteriſtics of which are inciſory teeth in both jaws; in the upper-jaw, always four teeth; two teats on the breaſt; and the arms ſeparated by a collar-bone. In this order there are four genera; namely, man *homo*, the ape *ſimia*, the maki *lemur* or *proſimia*, and the bat *veſpertilio*. It muſt be acknowledged, that this method does not very well agree with nature; for there is ſo wide a difference between man and the bat, that it is almoſt ſhocking to claſs them together.

The animals of the ſecond order are denominated *bruta*. Their characteriſtics are, the want of inciſive teeth, feet with ſtrong hooves, and ſlowneſs of motion in walking. This order contains ſix genera; the elephant *elephas*, the ſea-cow *trichechus*, the ſloth *bradypus*, the ant-eater *myrmecophaga*, the philodotus *manis*, and the tatou, or *daſypus*. There is a wide difference between the two former genera, and the latter four.

In the third order, which the Swediſh naturaliſt denominates *feræ*, wild beaſts, he includes all animals with paps, whoſe inciſory teeth are of a conical form, and generally in the number of ſix to both jaws,—the canine teeth very long, and the molares not flattened,—their feet armed with claws,—and who, in their habits of life, are rapacious and devour their prey. In this order, there are ten genera; the ſea-calf *phoca*, the dog, *canis*, the cat *felis*, the ferret *viverra*, the weaſel *muſtella*, the bear *urſus*, the *didelphis*, the mole *talpa*, the mouſe *ſorex*, and the hedgehog *erinaceus*.

The fourth order, intituled *glires*, the dormice, is diſtinguiſhed by the following characteriſtics. The animals belonging to it have two inciſory teeth on each jaw, but no canine teeth. On their feet, they have claws which fit them for leaping. They gnaw the bark and roots of trees, &c. This order comprehends ſix genera; the porcupine *hiſtria*, the hare *lepus*, the beaver *caſtor*, the rat *mus*, the ſquirrel *ſciurus*, and the American bat, named by Linnæus *noctilio*.

Under his fifth order, *pecora*, this naturaliſt comprehends all thoſe quadrupeds which have inciſory teeth in the under-jaw, but none on the upper, which have their hooves divided, and which chew the cud. The camel *camelus*, the animal which affords muſk *moſchus*, the ſtag *cervus*, the goat *capra*, the ſheep *ovis*, and the cow *bos*, are the ſix genera of which this order conſiſts.

Under the denomination of *belluæ*, the ſixth order, he comprehends quadrupeds with obtuſe, inciſory teeth, and hooves on their feet. The four genera of which this order conſiſts, namely, the horſe *equus*, the river-horſe *hippopotamus*, the hog *ſus*, and the unicorn *rhinoceros*,

ceros, are ſufficiently diſtinguiſhed from one another, by the number of their teeth, and the form of the feet.

Laſtly, the ſeventh order, comprehending cetaceous animals, *cete*, is diſtinguiſhed from the other orders by the form of the feet of theſe animals, which reſemble fins. As, however, we agree in opinion with ſeveral modern naturaliſts, who think that cetaceous animals ſhould be ranked in a particular claſs, we ſhall ſpeak of them after quadrupeds.

The method of Linnæus appears to be in many inſtances defective;—not only in bringing man and the bat, &c. improperly together, and in dividing with equal impropriety animals ſo nearly reſembling each other as the rat and the mouſe, &c.; but its diviſions are far from being ſufficiently numerous; nor will they help the ſtudent to diſtinguiſh any particular quadruped: And this is what muſt conſtitute the great merit of a ſyſtem of arrangement;—this is indeed the only advantage that can be gained by it.

KLEIN'S METHOD.

Klein divides quadrupeds into two great orde the firſt, comprehending quadrupeds with hooves, *pede ungulati ſive cheliferi;* the ſecond ſuch as have the feet digitated, *pedes digitati.*

The firſt order is divided into five families, which a diſtinguiſhed from each other according to the diviſio of their hooves. The firſt family, called *monochela*, (i French *ſolipede*) *ſingle-hoofed*, comprehends the gen of the horſe.—The ſecond, the individuals of which a

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diſtinguiſhed by the name of *dichela*, conſiſts of thoſe quadrupeds whoſe hooves are parted into two, or biſulcar *biſulci*. Some of theſe, ſuch as the bull, the ram, the buck, the ſtag, the giraffe, &c. have horns, Others again, ſuch as the boar, the hog, the babyrouſſa, are without horns.—The third family contains the *trichela*, or animals which have the hoof parted into three; of which there are none but the *rhinoceros*.—In the fourth family, whoſe peculiar characteriſtic is, to have the hoof parted into four, *tetrachela*, there is only the hippopotamus.—The elephant, the only animal whoſe foot is parted into five diviſions, conſtitutes the fifth family, *pentachela*.

The ſecond order of quadrupeds, containing thoſe which are digitated, is likewiſe divided into five families. The firſt conſiſting of animals with two toes on the foot, *didactyla*, comprehends the camel, and the ſloth of Ceylon.—The ſecond family, animals with three toes on the foot, *tridactyla*, conſiſts of the ſloth and the ant-eater.—In the third, Klein comprehends, under the name of *tetradactyla*, animals with four toes, tatous or amadilloes, and the *cavia*, which ſeems to be a ſort of rabbit.—The fourth family, characteriſed by having five toes, *pentadactyla*, is more numerous than any of the former families: it contains the rabbit, the ſquirrel, the dormouſe, the rat and the mouſe, the didelphis, the mole, the bat, the weaſel, the porcupine, the dog, the wolf, the fox, the *coati*, the cat, the tiger, the lion, the bear, and the ape:—a very conſiderable number of ſpecies are compriſed under theſe different genera. It is to be obſerved, that in all theſe characteriſtics, taken from the form of the feet, Klein, in diſtinguiſhing the families, conſiders only the fore-feet. Laſtly, the fifth family of digitated animals conſiſts of animals whoſe feet are irregular in reſpect to the number and diviſion of their toes, *anomalopada ;* ſuch as the otter, the beaver, the ſea-cow, and the phocas or ſea-calf.

The ſame objection may be made to Klein, as to Linnæus. The families are, indeed, ſufficiently diſtinguiſhed from one another; but the genera, eſpecially thoſe of the fourth family of digitated animals, cannot be well diſcriminated in his ſyſtem.

METHOD *of* M. BRISSON.

M. BRISSON has avoided moſt of the defects of other ſyſtems, by combining together all the characteriſtics which had been aſſumed by preceding naturaliſts: —The number of the teeth, the want of teeth, the form of the extremities, the ſhape of the tail, and the nature of the appendices—ſuch as horns, ſcales, and prickles. His ſyſtem cannot be denied to be the moſt compleat, and the beſt contrived to help us to diſtinguiſh any quadruped, and refer it to the genus to which it belongs. His diviſions are here exhibited in a table: it contains the generic characteriſtics of animals; and is very ſimple and eaſy.—*See Table II. at the end of this volume.*

ARTICLE II.

Of Cetaceous Animals.

Cetaceous animals, are great animals inhabiting he ſeas, which are enabled, by the ſtructure of heir lungs and blood-veſſels, to live under water,—as ve ſhall explain more particularly in the hiſtory of reſpiration. Being viviparous, they reſemble quadrupeds n the ſtructure of their breaſts, and of their internal orans in general; but the form of their extremities is ifferent,—as theſe ſpread into fins: And they have, eſides, two apertures in the upper part of the head, hrough which they ſpout water to a conſiderable eight. Theſe holes are called by naturaliſts *ſpiracula*. M. Daubenton tranſlates this word *(events) vents*. heſe animals are far from being equally numerous ith quadrupeds. M. Briſſon diſtinguiſhes them, 1. to Cetaceous animals wanting teeth, ſuch as the whale *læna*; 2. Cetaceous animals which have teeth only in e upper-jaw, ſuch as the *cachalot, monodon vel monoros;* 3, Cetaceous animals with teeth only in the der-jaw, ſuch as the narval or unicorn of the ſea, *yſeter;* 4. Laſtly, Cetaceous animals having teeth in th jaws, ſuch as the dolphin, *delphinus*.

ARTICLE III.

Of Birds. ORNITHOLOGY.

BIRDS are animals with two feet, which mov through the air by means of wings, are covered wi feathers, and have bills of a corneous ſubſtance. M ny facts concerning the forms of the bills, the ſtructu of the feathers, the motions and the habits of theſe nimals, are highly worthy of attention. The moſt im portant of thoſe facts will be given in an abridgeme of phyſiology, which is to follow in this volume. preſent, we are only concerned to give the extern characteriſtics by which the animals are diſtinguiſhe and ſyſtematically arranged. The firſt philoſophe who treated of this part of natural hiſtory, eſtabliſhe no diſtinctions among birds, but ſuch as depended their inhabiting in different ſituations. They diſti guiſhed them into birds of the woods, birds of t plains, birds of the thickets, ſea-fowls, river-fowls, birds frequenting lakes, &c. Others have diſtingui ed them by the ſpecies of food on which they live, into birds of prey, granivorous birds, &c. &c.

But the moderns who have formed ſyſtems of natu hiſtory, have taken a very different way of eſtabliſhi characteriſtic differences among them. Linnæus divided them, by the form of the bill, into ſix ord in the ſame manner as quadrupeds, with which he c pares them. But thoſe diviſions do not appear to

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ſufficiently numerous; eſpecially as the number of th ſpecies of birds is much more conſiderable than that of quadrupeds. Buffon makes the quadrupeds which are known, amount to two hundred different ſpecies; but the ſpecies of birds to fifteen hundred or two thouſand. —We ſhall here ſpeak only of Klein's and M. Briſſon's ſyſtematical arrangements of birds.

Klein divides birds into eight families, according to he form of their feet. The firſt, under the name of *idactylæ*, conſiſts of ſuch as have two toes on the foot: —the only bird belonging to this diviſion is the oſtrich. —The ſecond conſiſts of *tridactylæ*, ſuch as the caſſuary, he buſtard, the lapwing, the plover.—The third, the *etradactylæ*, have two toes before, and two behind, ich as the parrot, the woodpecker, the cuckoo, and e king's-fiſher.—The fourth comprehends the *tetra*-*actylæ* which have three toes before, and one behind. his family is more numerous than any of the reſt: it omprehends both diurnal and nocturnal birds of prey, vens, magpies, ſtarlings, thruſhes and blackbirds, rks, red-breaſts, ſwallows, tom-tits, woodcocks, bulnches, rails, croſsbills, gallinaceous fowls, herons, &c. —The fifth family contains *tetradactylæ* having their ree fore-toes connected by a membrane, but the toe hind ſeparate. Theſe birds are called *palmipedes*. his family conſiſts of geeſe, ducks, ſea-mews, and dirs.—The ſixth comprehends thoſe *tetradactylæ* which ve all the four toes connected by a membrane. They called in Latin *planci*. The pelican, the cormont, the *fool*, and the anhinga, are ranked by Klein in s family.—The ſeventh conſiſts of thoſe who have y three toes, and theſe connected by a membrane:

they are denominated *tridactylæ palmipedes.* The guillemot, the penguin, and the albatroſs, belong to this family.—Laſtly, the eighth conſiſts of *tetradactylæ* having on their toes fringed or ſcolloped membranes. They are called alſo *dactylobæ.* This laſt family conſiſts of the *colimba* and the coot.——Klein's method, though it deſcends to more particulars than that of Linnæus, is ſtill attended with numerous difficulties as to the diſtinctions of the genera; eſpecially thoſe of the fourth family. We therefore think M. Briſſon's preferable. The laſt, indeed, as the author has made uſe of the different characteriſtics in the ſame manner as in his claſſification of quadrupeds, appears at firſt ſight to be very complicated; but when reduced to a table, a we have done with it, it exhibits, at one glance, all the diviſions of which it conſiſts; and any particular bird may be eaſily diſtinguiſhed, by tracing thoſe diviſions. ——*See Table III. at the end of this volume.*

ARTICLE IV.

Of Oviparous Quadrupeds.

LINNÆUS, in his ſyſtem, arranged together, oviparou quadrupeds, ſerpents, and cartilaginous fiſhes, under th name of *amphibia.* But, M. Daubenton is of opinion that the word *amphibia* cannot be properly applied t any claſs of animals: for it muſt mean animals which liv either in air or in water, as long as they pleaſe; an there is no claſs poſſeſſed of this property: Were th

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denomination, again, to be applied to all terreſtrial animals capable of living for any ſpace of time, however ſhort, under water,—and all aquatic animals capable of living in the air,—all animals would then be amphibious. In the ſame claſs, but in two diſtinct orders, Linnæus ranks both oviparous quadrupeds, and ſerpents; and thoſe amphibious animals which practiſe ſwimming, he ranks among fiſhes.

In M. Daubenton's ſyſtem, oviparous quadrupeds compoſe the fourth order of animals. Their organization is by no means imperfect: for they, like the quadrupeds, cetaceous animals, and birds ranked before them, have a head, noſtrils, and ears ſituated within the head. But, the following characteriſtics diſtinguiſh this claſs from the three preceeding orders: 1. They have only one ventricle in the heart: 2. Their blood is almoſt cold: 3. They reſpire only after long intervals: 4. They are oviparous, and conſequently without teats.——The laſt of theſe characteriſtics is common to them with the four following orders of animals. Laſtly, no other animals but they, have four feet without hair.

M. Daubenton obſerves, that the differences among he various genera belonging to this order are ſo confiderable, as to render it impoſſible to communicate any general notions common to them all. Of this he treats in the hiſtory of each particular genus, under the words, ortoiſes, lizards, toads, frogs, in the ſecond volume of he Natural Hiſtory of Animals, which forms a part of he *Encyclopædie Methodique.*

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The claſſification and the characteriſtics which that lebrated naturaliſt has given of the order of oviparous adrupeds, is one of the moſt complete and the beſt executed parts of the natural hiſtory of animals: and I have, therefore, formed into a table, all M. Daubenton's diviſions, from claſſes to ſpecies, as the number of the ſpecies is not above 100.--*(See Table IV.)* Since the publication of M. Daubenton's work, the Count de la Cepede has publiſhed a very complete and accurate work on oviparous quadrupeds, in which he exhibits a peculiar method of arrangement. This method is laid down in the fifth table, which is extracted from M. de la Cepede's work.

ARTICLE V.

Of Serpents.

SERPENTS form the fifth order in M. Daubenton's diviſion of animals. Theſe are ſufficiently diſtinguiſhed, by having their bodies covered with ſcales, and being without feet or fins. They have a head, noſtrils, ears within the head, only one ventricle in the heart, and their blood is almoſt cold: they reſpire only after long intervals, and produce eggs like oviparous quadrupeds. Serpents have neither neck nor ſhoulders. The ſcales with which they are covered, are of three ſorts. They are either rhomboidal, and riſing over each other like tiles, to which form and diſpoſition, Linnæus gives the name of *ſquammæ;* or elſe of an oblong ſquare form and diſpoſed one beſide another,—and theſe Linnæus calls *ſcuta* or plates;—when very ſmall, and ſtill of the form, they are denominated *ſcutella* or ſmall plates: Or laſtly, they form rings round the body of the ſerpent,-- as in the amphiſbæna.

Though ſerpents be without feet, yet they often move nimbly enough, by fixing the fore-part of the body, raiſing the middle, and then bringing forward the hinder part; they reſt on the tail, and ſpring to a diſtance to attack their prey. They change their ſkin once or twice a year.

Some ſerpents are venomous. Of 131 ſpecies of which Linnæus takes notice, 23 are by that naturaliſt reckoned dangerous. All of theſe animals whoſe bite is dangerous, have, on each ſide of the upper jaw, a tooth conſiderably larger than their other teeth; at the root of which is a cell filled with a peculiar fluid, which they pour into the wound through a groove in the tooth.

It cannot now be conſidered as a matter of doubt, after the teſtimony of ſo many reſpectable authorities, that there are ſpecies of ſerpents of a very extraordinary ſize. M. Adanſon, from a number of very accurate facts, fixes the ſize of the largeſt ſerpents, at forty or fifty feet in length, and a foot and an half in thickneſs.

Of all naturaliſts, M. Laurenti has entered the moſt minutely into the claſſification of ſerpents. He diſtributes them into 17 genera. But M. Daubenton rejects the ſyſtem of this naturaliſt, becauſe it is ſo exceedingly difficult to recogniſe the diſtinctive characters; adopting in preference to it, that of Linnæus.—The ſixth table, at the end of this volume, contains the diviſions and characteriſtics of ſerpents, from genera, to no fewer than one hundred and twenty-ſeven ſpecies which have been enumerated by M. Daubenton.

ARTICLE IV.

Of Fiſhes. ICHTHYOLOGY.

FISHES are a very different ſort of animals from thoſe which we have hitherto been conſidering: the ſtructure of their internal organs is altogether peculiar, as will be ſhewn in our abſtract of phyſiology. They differ from other animals, in having, inſtead of feet, fins which enable them to move in water,—and in reſpiring water inſtead of air. It is much more difficult to gain a knowledge of fiſhes, than of other animals; and accordingly, the natural hiſtory of fiſhes is very imperfect.

In order to underſtand the methodical diviſion of theſe animals, which we are about to propoſe from Artedi, Linnæus, and M. Gouan, it will be neceſſary for the reader to take a haſty view of the anatomy of the exterior parts of their bodies. The bodies of fiſhes may be divided into three parts: the head, the trunk of the body, and the fins.

The heads of theſe animals are of various forms:—Either horizontally or laterally flattened, or round: either naked or ſcaly: ſmooth, or overſpread with aſperities, tubercles, &c.—The lips have been obſerved to be either fleſhy or bony, with appendices or barbels, ſoft, and very moveable: the teeth are fixed, either to the jaws, the palate, the tongue, or the gullet: their eyes are two in number, motionleſs, and without eye-lids: the channels of their noſtrils are double on both ſides: they have an opening at the gills or bronchiæ: they are provided with bones, either round, triangular, or ſquare, to ſhut this opening: the bronchial membrane is placed under theſe, and ſupported by ſeveral other bones, in the form of a bow, the number of which varies from two to ten. This membrane folds back on the bones above it; and it is an object of importance to examine the varieties of its ſtructure,—as he characteriſtics of genera are often taken from the number or form of the radii.

The form of the trunk varies, as well as that of the head. It is either round, or globular, or oblong, or flat, r angular. In it are to be obſerved the lateral lines, hich ſeem to divide each ſide of the body into two parts:—The thorax, ſituated immediately below the ills, at the upper extremity of the trunk, and filled ith the heart and bronchiæ:—the belly, the ſides of hich extend from the head to the tail, and which conains the ſtomach, the liver, the air-bladder, and the enital organs:—the orifice of the anus, common to he inteſtines, the bladder, and the organs of generaion:—and laſtly, the tail, which terminates the trunk, nd of which the form and ſize are various.

The fins, *pinnæ natatoriæ*, conſiſt of membranes, ſuported on ſmall radii, of which, ſome are hard and bony, nd terminate in a thorny point,—which has procured the fiſhes to which it belongs, the name of *acanthoperygii* from Artedi; others are flexible, ſoft, obtuſe, nd ſeemingly cartilaginous,—and characteriſe the fiſhes which they belong, as *malacopterygii*. The fins are iſtinguiſhed into five ſorts, according to their ſituations;

tions; dorſal, pectoral, abdominal, thoſe of the anus, and of the tail.

The dorſal fin maintains the fiſh in equilibrium. It is diverſified by ſituation, figure, number, proportion, &c.

The fins of the thorax are ſituated at the opening of the gills: they are two in number: they ſerve the purpoſe of arms, and ſometimes even of wings*; they differ in ſituation, extent, figure, &c.

The fins of the belly are more particularly worthy of notice; for, from their ſituation has the celebrated Linnæus taken his diſtinctive characteriſtics in claſſing fiſhes. Theſe fins are ſituated on the lower part of the body, above the anus, and always lower and nearer each other than the pectoral fins. They are ſometimes wanting; and as Linnæus compares them to feet, he calls ſuch fiſhes as want theſe fins *apodes*. Moſt fiſhes, however, are poſſeſſed of them; but they are not always inſerted at the ſame place. When they are ſituated either before or immediately under the opening of the gills and the pectoral fins, both they and the fiſhes to which they belong, are called *jugular*. When fixed to the thorax, and behind the opening of the gills, they are called *thoracic:* And, in Linnæus's ſyſtem, fiſhes of this ſtructure are diſcriminated by the ſame name. Laſtly, when placed under the belly, and nearer the anus than the pectoral fins, they are called *abdominal;* and, in like manner as before, communicate their name to the order of fiſhes which have them in this ſituation.

The fin of the anus is an odd one: it occupies, either in whole or in part, the region between the anus and

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the tail. It is liable to varieties of form, number, and ſize. Yet, none but the golden-fiſh of China, are known to have two of theſe fins.

The tail fin is diſpoſed vertically at the extremity of the body, and terminates the tail. The fiſh uſes it as a rudder, moving it, ſo as to change the direction in which it ſwims, at pleaſure. It is likewiſe ſubject to ſome varieties in its form, its adherence or connexions, its extent, &c.

After this account of the anatomy of the exterior parts of fiſhes, we may paſs to the ſyſtematic diviſions in which naturaliſts have arranged them. Before Artedi, no naturaliſt had attempted a ſyſtematic arrangement of fiſhes; although claſſifications of the other animals had been already formed. This philoſopher was the firſt who offered to the world, a ſyſtem of ichthyology formed on the nature of the fins, as hard or ſoft, pointed or obtuſe, and on the form of the gills. He afterwards engaged in a deſign to extend the diviſions by characteriſtics taken from other parts; but was prevented by a premature death, from accompliſhing his deſign. Linnæus contrived to form a ſyſtem of ichthyology, on the variations of the poſition of the fins of the belly: And M. Gouan, a celebrated profeſſor of Montpellier, has very happily combined the two ſyſtems of Artedi and Linnæus. This naturaliſt divides fiſhes firſt into thoſe whoſe gills are perfect,—that is to ſay, conſiſt of an *operculum*, and a bronchial membrane regularly organized; and thoſe whoſe gills are imperfect,—that is, which want either the operculum, or the bronchial membrane, or both. The firſt mentioned, are thoſe diſtinguiſhed by the form of their fins.—In fact, theſe parts conſiſt either of hard, pointed bones, or of ſoft, and ſeemingly cartilaginous radii. Theſe diſtinctions eſtabliſh three different claſſes of fiſhes: 1. The acanthopterygii; 2. The malacopterygii: and, 3. The bronchioſtegi. In each of theſe claſſes, the belly-fins being either wanting, or placed on the neck, on the thorax, or on the belly; M. Gouan therefore divides each claſs into four orders: *apodes*, jugular, thoracic, and abdominal.

The diſtinctive characters of the genera, under theſe diviſions, are taken from the form of the body, the head, the mouth, the bronchial membrane, and more eſpecially the number of the radii which ſupport that membrane.——*See Table VII.*

ARTICLE VII.

Of Inſects. ENTOMOLOGY.

INSECTS are diſtinguiſhed by the form of their body which ſeems to be divided into rings; and by two moveable horns on the fore part of the head, called *antennæ.* Inſects form one of the moſt numerous claſſes of animals, on account, no doubt, of their diminutive ſize; for it has been obſerved that the ſmaller animals are, ſo much the more numerous are they. The hiſtory of theſe animals is one of the moſt agreeable and amuſing branches of natural hiſtory; perhaps, too, not the leaſt uſeful;

for, in proſecuting it, many diſcoveries may be made, beneficial both to medicine and the arts.

Inſects, in their manners, form, habitation, &c. diſplay in miniature, almoſt the whole œconomy and characteriſtics of other animals. Some inſects walk like quadrupeds; others fly like birds; ſome ſwim, and live in water, like fiſhes; and laſtly ſome leap and trail along, like certain reptiles. This analogy might be even traced much farther, by examining, particularly, the ſtructure of their extremities, mouth, aud interior organs, &c.

Inſects, conſidered as to external appearance, conſiſt of three parts: an head, a corſelet, or breaſt, and a belly.

The form, ſize, and poſition of the head are various. It is ſometimes very large in proportion to the bulk of the inſect, and ſometimes very ſmall: it is either round, or ſquare, or oblong; either ſmooth, or overſpread with ſmall holes, or tuberculated, or covered with hair in certain places. On it are obſerved, 1. The antennæ, placed near the eyes, and conſiſting of ſeveral different, articulated, moveable pieces, like a thread, terminating either in a point, or in a knob: the form of the antennæ is to be always carefully obſerved; for it affords by its varieties, generic characteriſtics: 2. The eyes which are of two ſorts, either with facets, or in a ſort of network, ſmooth and ſmall: theſe organs are ſometimes very large, and ſometimes ſmall; their number varies: ſome inſects have only one eye, and are diſtinguiſhed as monocular; others, ſuch as the ſpider, have two, five, or even eight: 3. The mouth, which conſiſts either of ſhort corneous jaws, placed laterally, and moveable

able towards the ſides; or of a proboſcis, either longer or ſhorter, dilated or ſpiral, &c.; or of a ſimple gap or orifice, &c. This part is often armed with ſmall moveable appendices, denominated antennulæ or barbels, and either two or four in number.

The corſelet is the breaſt of the inſect, placed between the head and the belly. It is ſometimes round, ſometimes triangular, cylindrical, broad, and narrow, &c. It is to be conſidered as a ſort of cube conſiſting of ſix ſides; and its form is ſometimes regularly cubic. The front, or anterior extremity, is hollowed for the reception of the head. In flies, for inſtance, the junction of the head to the body, at this part, is ſometimes formed merely by a thread. The poſterior extremity, again, is commonly round, and articulated with the firſt ring of the belly; ſometimes it is joined to that part by a thread. The upper facet is ſometimes flat and ſmooth, ſometimes round, prominent, bearing appendices, tuberculated, and terminating in a jutting border: This forms what is called the bordered corſelet, *thorax marginatus*.—The wings are faſtened to the poſterior part of this facet. It is well known, that moſt inſects are provided with wings; but that their wings differ amazingly from each other. It may be of conſequence, briefly to conſider theſe diverſities of the ſtructure of the wings of inſects; as naturaliſts have eſtabliſhed on them the leading diviſions of their claſſifications of theſe animals.

The wings of inſects are either two or four in number. Inſects having two tranſparent wings, ſuch as the fly, the gnat, &c. have always, towards the part where the wing joins the body, and under it, a ſmall filament terminating in a round button, called the *balance*; and covered with a concave, membranous appendage, called the *bowl.* In many inſects, theſe two wings are very ſtrong, twiſted and plaited under hard, corneous, moveable ſheaths, called *elytra.*—Theſe ſheaths are of various forms: ſome of them cover the whole belly; others are cut tranſverſely, and cover only a part of the belly: ſome of them are hard; others ſoft: moſt of them have, near the place of their juncture, a ſmall triangular piece ſoldered to the corſelet, which is called *ſcutellum;* others want this ſmall piece. Laſtly, a number of inſects with ſheaths, have the elytra ſoldered ſo as to form ſeemingly but one piece, and motionleſs.

The wings are often four in number; they are then either membranous and tranſparent, as in the dragon-fly, the waſp, &c. or apparently ſprinkled with a coloured duſt, which, when viewed through the microſcope, proves to be ſcales riſing one over another, on the wing, as tiles on the roof of a houſe, *imbricatim.*

The lower part of the corſelet is irregular in its form; it conſiſts of ſeveral pieces glued one over another, and bears a part of the legs.—The number of the legs varies: Many inſects have ſix legs; and others, ſuch as the ſpider, have eight legs: ſome, again, have ten, like crabs; and laſtly, there are ſome which have a ſtill greater number. Wood-lice are obſerved to have ſixteen; and ſome ſpecies of the ſcolopendra have from ſeventy to one hundred and twenty on each ſide. According to M. Geoffroy, the legs of thoſe inſects which have only ſix or eight, are fixed to the corſelet; but ſuch as poſſeſs a greater number, have a part of them inſerted in the rings of the belly.

The leg of an inſect conſiſt always of three parts:—the thigh—the part next the body, the leg, and the tarſus. Beſide theſe there is often an intermediate piece between the body and the thigh. The tarſus conſiſts of ſeveral pieces or rings articulated one with another: the number of theſe rings varies from two to five. There are even ſome inſects which have the tarſus larger in the fore, than in the hinder legs; which eſtabliſhes an analogy between the ſtructure cf theſe ſmall animals and that of many quadrupeds, which have more toes on the fore than on the hinder feet. M. Geoffroy, as we ſhall afterwards ſee, has aſſumed a part of this character for the baſis of his ſyſtematic diviſion of inſects. The tarſus is terminated by two, four, or ſix ſmall claws, and has generally, on the under ſide, ſeveral ſmall bruſhes, or ſpongy clues, which enable the inſect to adhere even to the moſt poliſhed bodies, ſuch as ice, &c.

On each ſide of the corſelet, there are obſerved, one or two oblong, oval apertures, called ſtigmata, by which the inſect reſpires.

The third part of the body of an inſect, is the belly. It generally conſiſts of corneous rings, or half-rings, enchaſed in one another. Sometimes, no ſuch rings are obſerved, but the belly appears to conſiſt all of one piece. Female inſects have uſually larger bellies than the male. At the extremity of the belly are the parts of generation: On the ſides, each ring but the two loweſt, is perforated with a ſtigma. At the lower part of the belly, too, many inſects bear their ſtings; of which, ſome are ſharp-pointed, others ſerrated, and others of an auger form.—They uſe them as weapons of defence, and as inſtruments for forming cells in which they may depoſite their eggs.

The moſt ſingular phenomenon which inſects exhibit,—which, more than any thing elſe, diſtinguiſhes them from moſt other animals,—is, their paſſing through different ſtates by a ſort of metamorphoſis, before they become perfect inſects. Some inſects,—almoſt all thoſe belonging to the claſs of *aptera*, ſuffer no ſuch changes; but by far the greateſt number of theſe animals are ſubject to them. The inſect is not of the ſame form with its parent, when it iſſues from the egg; it is then a worm, either with or without legs; and, in this ſtate, theſe animals exhibit great diverſities in the head and the rings. In this firſt ſtate, the inſect receives the name of *larva:* under this maſk, it eats, grows bigger, moves, and changes its ſkin ſeveral times. When it attains its full ſize, it changes its ſkin for the laſt time; and is now no longer a worm or larva, but in a totally different form; in which it is known by the names, *nympha, chryſalis, aurelia.*

M. Geoffroy diſtinguiſhes *nymphæ* into four different ſpecies.—The firſt bears no reſemblance to an animal.—Only a few rings are obſerved on its under part; and above, only ſome very imperfect marks of antennæ, legs, and wings.—The ſkin of this ſpecies of nymphæ is hard and cartilaginous; and only ſome of its rings are moveable.—Such are the nymphæ of butterflies, &c.

The ſecond ſpecies of chryſalis exhibits the parts of the perfect animal, wrapped in a very thin ſoft ſkin.—Like that of the former ſpecies, it is immoveable. Inſects with caſes, inſects with four naked wings, and inſects with two, paſs through this ſtate.

The third ſpecies diſplays the parts fairly unfolded, very conſpicuous and moveable.—Such are the chryſalides of gnats, and inſects which, in the firſt ſtates, paſs their life under water.

Laſtly, the fourth ſpecies conſiſts of thoſe which, in the form of the body, their legs and antennæ, reſemble the perfect inſect. Theſe nymphæ walk and eat: the only difference between them and perfect inſects, is, that they want wings, and are incapable of generation. —The nymphæ of the dragon-fly, the bug, the graſhopper, and the cricket, are of this ſort.

Inſects, like other animals, were not diſcriminated by ancient naturaliſts, otherwiſe than by the ſituations in which they inhabited. Before Linnæus, no philoſopher had attempted a ſyſtematic arrangement of them, in which they might be diſtinguiſhed by certain characters.—The firſt claſſification of inſects was formed by that naturaliſt. After him, M. Geoffroy attempted a more accurate claſſification of them.—His diviſion of inſects into ſections and genera, is a maſter-piece of preciſion and perſpicuity: It is this naturaliſt's ſyſtem which we have adopted. M. Fabricius has ſince attempted a diviſion of inſects, by the form of the jaws.

M. Geoffroy divides inſects into ſix ſections, according to the number, the ſtructure, or the want of the wings. The firſt ſection contains *coleoptera*, or thoſe inſects which have their wings covered with caſes. Their mouth is formed by two lateral and corneous jaws, and is the ſecond general characteriſtic of this ſection. The May-bug diſplays theſe two characteriſtics.

The ſecond ſection comprehends the *hemiptera*, whoſe upper wings are either ſomewhat thick and coloured, or half hard and opaque; but in this ſection, the wings do not afford ſo certain and conſpicuous a characteriſtic as the mouth. The mouth is a long, acute trunk, folded down between the legs. To this ſection belong the wood-bug, and the balm-cricket.

The third ſection conſiſts of *tetrapterous inſects with mealy wings*, whoſe four wings are coloured by a ſcaly duſt, which have a trunk, ſometimes longer, ſometimes ſhorter, frequently ſpiral; as, for inſtance, the butterfly. Linnæus calls theſe inſects *lepidoptera*.

The fourth ſection conſiſts of *tetrapterous inſects having naked wings*. Their four wings are membranous: they have hard jaws.—Such is the waſp. Linnæus has divided theſe inſects into two orders: The *neuroptera*, which have no ſting on the anus, and have their wings divided by nerves; and the *hymenoptera*, which have a ſting at the anus, and have membranous wings, but no very diſcernible nerves in them.

The fifth ſection conſiſts of *dipterous* inſects, or inſects with two wings. Their mouth is generally of a trunk-form; and, at the root of the wing, they have poiſers with knobs at the extremity, ſerving to balance them.

Laſtly, in the ſixth and laſt ſection, are ranked the *ptera*, inſects deſtitute of wings, ſuch as the ſpider, the uſe, &c.

Beſide theſe primary diviſions, M. Geoffroy has eſtabliſhed ſome others, to aſſiſt the collector of inſects.—*See Table VIII.)*

Although ſeveral celebrated naturaliſts have, ſince M. Geoffroy, turned their attention on the hiſtory of inſects; and although M. Fabricius has publiſhed a new ſtem of the claſſification of inſects, in which the characteriſtics are taken from the organs with which they receive their food; yet I have preferred M. Geoffroy's ſyſtem, which, as it contains fewer genera and ſpecies, is far from being ſo complicated and perplexing as that of M. Fabricius.

ARTICLE VIII.

Of Worms. HELMINTHOLOGY.

Worms are ſoft animals, very different in form from inſects, with which they have been, by many naturaliſts, confounded, and far from being ſo perfectly organized. They have, properly ſpeaking, no bones;—the conformation of their members does not reſemble that of inſects, nor are they liable to paſs through different ſtates. Few of them are known to have organs for generation: Moſt of them have no head, regularly formed; and they are all diſtinguiſhed by the want of feet and ſcales.

The claſs of worms is the moſt numerous, and the leaſt known of all the claſſes of animals. There are few organized bodies, either dead or living, in which worms are not found. Moſt naturaliſts have arranged worms and polypi under one claſs. They might perhaps be better ſeparated; as they are widely different in reſpect to their interior ſtructure and habits. Moſt worms have a heart and blood-veſſels; but no ſuch organs have been obſerved in polypi.

The worms on which our attention is at preſent engaged, are to be carefully diſtinguiſhed from the larvæ of inſects, which have likewiſe received the name of worms on account of their form. Their head has jaws; their legs are more or leſs numerous, but generally about ſix; and theſe parts afford characteriſtics by which they may be diſtinguiſhed.

Worms are very much diſpoſed to motion; moſt of them are fond of moiſture, and ſeek after it. In ſome, the form of the head is not very perfect; and they are moſtly hermaphrodites. Such as have heads, have upon them two moveable horns, which they can draw inwards, and which are called *tentacula*. It appears, that almoſt all worms, when mutilated, reproduce the parts which they loſe. This ſhews their organization to be very ſimple; and in this particular they reſemble polypi.

This claſs of animals may be divided into four ſections: The firſt containing naked worms, the organization of which is beſt known, and which, in this property nearly reſemble other animals. In the ſecond ſection, we may arrange worms with a teſtaceous covering,—ſhell-worms. The organization of theſe is not ſo well known as that of the former claſs; but M. Adanſon's reſearches have ſhewn their ſtructure to be nearly the ſame with the ſtructure of naked worms. The third ſection may comprehend worms having a cruſtaceous covering. Of theſe, the organization is leſs known than that of either of the two preceding ſections; nothing but their external form, and the ſtructure of their mouth having been yet examined. The polypi belong to the fourth ſection. Many naturaliſts have already employed themſelves on the ſyſtematic diviſions of theſe different ſections. In the diviſion in the eighth table, we have followed Liſter, Linnæus, Klein, Ellis, Pallas, D'Argenville.——*(See Table VIII.)* Since that period, M. Brugniere who has paid great attention to this part of natural hiſtory, and who is intimately acquainted with the ſtructure of worms, has publiſhed in the Encyclopedie Methodique a ſyſtem of claſſification, which we have thought proper to adopt and exhibit.—*(See Table IX.)*

SECTION II.

Of the Functions of Animals, from Man to the Polypus.

THE characteriſtics of living organic bodies, are, as we have already obſerved ſeveral times, the different functions which they perform with their organs. Theſe we have conſidered in vegetables; and, the order which we have obſerved, requires us to conſider them alſo in animals.

The department of medicine to which it belongs to examine the functions of animals, is Phyſiology. This valuable ſcience ſhould not be confined to man; it ought to be extended to all animals: And in this light are we going to take a haſty view of it at preſent.

The functions of animals may be reduced to the following:

1. Circulation.
2. Secretion.
3. Reſpiration.
4. Digeſtion.

5, Nutrition.
6. Generation.
7. Irritability.
8. Senſibility.

Theſe different functions belong to man, quadrupeds, cetaceous animals, birds, oviparous quadrupeds, ſerpents, fiſhes, inſects. Worms and polypi are not capable of them all; and the other claſſes diſplay them in different degrees.

ARTICLE I.

Of Circulation.

Circulation is one of the firſt functions of animals: it is the function by which life is maintained: when it ceaſes, the animal immediately dies: the organs employed in it are the heart, the arteries, and the veins.

The heart is a conical muſcle, with two cavities in its bottom, which are called *ventricles*. Beſide theſe are ſituate two ſmaller bags called *auricles*. Out of the left ventricle, there proceeds a large artery, which is called the *aorta*, and diſtributes the blood through the whole body. Another artery, equally large, likewiſe proceeds from the right ventricle: this is called the *pulmonary artery*, becauſe it ſpreads, in ramifications, through the lungs. The right auricle receives the blood as it returns

turns from its circulation through the whole body, by the two *venæ cavæ.* This fluid paſſes from the right auricle into the right ventricle. From the right ventricle, it iſſues into the lungs, through the pulmonary artery. Through the pulmonary veins, it proceeds into the left auricle: it paſſes thence into the left ventricle; and from the left ventricle, by the aorta, through the whole body.

This motion, which proceeds in this manner in the human body, forms two ſorts of circulation;—circulation through the whole body, and the circulation in the lungs. The latter was known before the former. The general circulation was diſcovered by Harvey, an Engliſh phyſician.

In quadrupeds, cetaceous animals, and birds, this function is carried on preciſely in the ſame way as in man. In fiſhes, the heart has only one ventricle; and, in them, the lungs, or gills, do not receive the blood through a particular cavity in the heart. In reptiles, this function is performed in the ſame way as in fiſhes. In inſects and worms, the heart conſiſts of a ſeries of knots, which contract, one after another: their veſſels are very ſmall, and their blood cold and colourleſs. Polypi have neither a heart nor blood-veſſels: In them, this function is carried on in a more imperfect manner than even in vegetables.

ARTICLE II.

Of Secretion.

Secretion is a function by which there are ſeparated from the blood, in different organs, juices deſigned for particular purpoſes, ſuch as the bile in the liver, &c. This function is one of the moſt general among animals: it takes place through all the claſſes; but we cannot deſcribe it as it is performed in them all, without running into too tedious a detail of particulars. We ſhall only obſerve, therefore, that, in all animals in which a real circulation is carried on, ſecretion is regulated by the ſame laws as in the human ſpecies; and appears to take place even in moſt of thoſe animals which have no heart. Beſide that analogy which muſt neceſſarily ſubſiſt between man and ſuch animals as are poſſeſſed of the ſame organs, in reſpect to the function of which we are now ſpeaking; almoſt every different claſs of animals has peculiar ſecretions which are not obſervable in the human ſpecies:—ſuch are the ſecretions of muſk and civet, among quadrupeds; of the white of the whale, and ambergriſe, among cetaceous animals; of the oily juice with which birds dreſs their feathers; of the virulent humour of the viper; of the glutinous fluid of the ſcales of fiſhes; of the acid and acrid juices of the bupreſtes, ſtaphylini, ants, and waſps, among inſects; of the viſcid mucilage of ſnails; of the colouring juices of purple; and of many others, which come to be taken notice of under the natural hiſtory of the different ſpecies of animals.

ARTICLE III.

Of Reſpiration.

Respiration, conſidered as it takes place in all animals in general, is a function which brings the blood into contact with the fluid in which they live. For this purpoſe, man and quadrupeds are poſſeſſed of an organ called the *lungs*.—It is a collection of hollow veſicles, which are nothing more but ramifications of a membranous and cartilaginous duct, called the *trachea arteria*,—and of the blood-veſſels, which, with their ramifications, form a great many areolæ on the ſurface of the bronchial veſicles. Theſe veſicles and veſſels are ſupported by a looſe and ſpongy cellular texture, which forms the parenchyma of the lungs. The air, when inhaled, diſtends theſe veſicles. The oxigene of the atmoſphere combines with the carbone diſengaged from the blood, and thus forms carbonic acid, which, together with gas azote, is exhaled. A certain quantity of hydrogene is likewiſe diſengaged from the venous blood, which by its union with the oxigene of the atmoſphere, forms the water that is exhaled with the air. Another portion of water proceeding directly from the pulmonary tranſpiration, is diſſolved in the air that is expired.

Caloric being ſeparated from the vital air, unites with the blood and reſtores it to the temperature of 93 or 94 degrees. Thus, the uſe of this function appears to be the formation of the blood, and the production of its temperature; while it ſerves at the ſame time, to carry off ſome ſuperfluous principles with which this is loaded, by the addition of the chyle and the changes which it undergoes in the courſe of the circulation.

In cetaceous animals, this function is performed in the ſame manner: Only, as in theſe animals there is a direct communication between the two auricles, they are capable of remaining for ſome time without reſpiration.

In birds, reſpiration is performed much in the ſame way as in the above-mentioned animals; but its influence extends much more through the body. Anatomiſts have diſcovered, in the belly of birds, ſpongy veſicular organs, which communicate with their lungs; and the lungs again extend to the bones of the wings,—which are hollow, without marrow,—by a duct which riſes from the upper part of the breaſt, and opens into the upper and inflated part of the os humerus. This noble diſcovery, which was made by M. Camper, ſhews, that the air paſſes from the lungs of birds into the bones of their wings. And this fluid being rarefied by the heat of the body, renders them very light, and contributes greatly to their flying.

The extent of the pulmonary organ likewiſe accounts for the temperature of the blood being higher in birds than in man, in quadrupeds or in the cetaceous claſs. The ſame cauſe ought likewiſe to produce particular modifications of the nature of this fluid, upon which depend thoſe differences that are found in their fleſh and in all their ſolids.

Fiſhes have, inſtead of lungs, gills or bronchiæ. Theſe organs conſiſt of membranous fringes, diſpoſed on an arcuated bone, and full of blood-veſſels. Water enters by the mouth, paſſes among the fringes, ſeparating them from one another, preſſes upon, and agitates the blood, and paſſes out by two lateral apertures behind the head, on which are two moveable oſſeous valves, called *opercula*, ſupported by the bronchial membrane. Duverney imagined that the gills ſeparated the air contained in the water. M. Vicq d'Azir, who has employed himſelf a good deal on the anatomy of fiſhes, is of opinion, that, in their gills, water acts the ſame part which air acts in the lungs of other animals. One thing certain is, that, as theſe animals do not reſpire air, or produce from it carbonic acid, their blood is not of the ſame degree of heat which that elaſtic fluid communicates to the blood of animals which reſpire it: Nor does it appear to be of the ſame nature with the blood in man, quadrupeds, birds.

Inſects are deſtitute of lungs. They have two ducts, or tracheæ extending along the back, with which, on each ſide, a number of other ſmaller ducts communicate; and theſe terminate, one on the outer ſide of each ring, by ſmall orifices, called *ſtigmata*. The ſtigmata rather appear to be deſigned for the expiration of a particular elaſtic fluid; for inſects do not die immediately in vacuo; but when the ſtigmata are cloſed up, they are thrown into convulſions, and die in a few ſeconds. The organization of worms is ſtill more imperfect. Polypi are not known to reſpire at all: in this function, therefore, they are more imperfect than vegetables, in which tracheæ have been found.

ARTICLE IV.

Of Digeſtion.

Digestion is the ſeparation of the nutritious matter contained in food,—and its abſorption by certain veſſels, called *lacteals.* It takes place in a canal running between the mouth and the anus, which, in the human body, is dilated towards the upper part of the abdomen. The part dilated, is called the *ſtomach*, or ventricle. The alimentary canal then becomes narrower: It is twiſted in different directions, and takes the name of *inteſtina.* This long tube, conſiſting of muſcles and membranes, is intended to detain the aliments till all the nutritious matter be extracted from them. There are alſo other glandular organs ſituated near the ſtomach, the purpoſe of which is to prepare fluids for ſtimulating the ſtomach and inteſtines, and to extract the nutritious part of the aliments. Theſe organs are the liver, the ſpleen, and the pancreas. The bile and the pancreatic juice run into the firſt inteſtine called the *duodenum,* and mix with the aliments: Before that mixture takes place, the aliments are diſſolved in the ſtomach by the gaſtric juice.

The ſmall inteſtines, through their whole length, are perforated with the orifices of veſſels, the buſineſs of which is to take up the chyle. Theſe veſſels convey t into the lumbar receptacle, and the thoracic duct; nd the chylous fluid is thus diſcharged into the left ſublaviar vein; where it mixes with the blood.—Such are he mechaniſm and the phenomena of digeſtion in the uman body.

Quadrupeds differ widely from one another, in the orm of their teeth, ſtomach, and inteſtines. Some of heſe animals, as for inſtance, the philodotus and the nt-eater, are without teeth, and eat nothing but ſoft liments. Others, ſuch as the tatou and the ſloth, have nly the *molares*. Some, ſuch as the elephant and the ea-cow, have both the molares and the canine teeth. aſtly, moſt quadrupeds have three ſorts of teeth—mo- ares, canine, and inciſory. What is moſt ſtrikingly re- arkable in the diverſified ſtructure of the teeth, as has een remarked by Ariſtotle, Galen, &c. is, that there xiſts, invariably, a relation between the number and oſition of the teeth, and the form of the ſtomach. ll quadrupeds having inciſory teeth in the two jaws, e horſe, the ape, the ſquirrel, the dog, the cat, &c. ave only a membranous ventricle, like that of the hu- an ſpecies. Anatomiſts call theſe animals *monogaſtric*. n them, the function of digeſtion is performed in the me way as in the human body.—Quadrupeds having ciſory teeth only in the under jaw, are *polygaſtric* and minating,—ſuch are the camel, the camelopardalis, e buck, the ram, the cow, the ſtag, and the kid. heſe quadrupeds are generally biſulcar and horn- d; they have all four ſtomachs. The firſt is called, the cow, the *paunch*: it is the largeſt, and is di- ded into other four bags. It, together with the ſe- nd, which opens into the paunch by a large orifice, receives the aliments.—In theſe organs, herbaceous aliments are dilated, and their air rarefied: theſe ſtimulate the nerves, and thus produce an anti-periſtaltic motion, which throws them back into the œſophagus and the mouth, where they undergo a new comminution by the dentes molares; and being reduced into a ſort of ſoft paſte, they are again ſwallowed, and, together with the drink of the animal, conveyed into the third ſtomach, the *omaſus*, through a ſemi-canal extending between the œſophagus and that ventricle. Laſtly, from the omaſus they are conveyed into that ventricle, which, in calves, is called the *rennet-bag*, and there thoroughly digeſted.—The inteſtines of ruminating animals are alſo much larger than thoſe of monogaſtric quadrupeds. The mechaniſm with which cetaceous animals are provided for this function, is exactly like that of monogaſtric quadrupeds.

Birds differ from one another in the ſtructure of the ſtomach: in ſome, it is membranous,—in others, muſcular. Thoſe poſſeſſed of the former characteriſtic, which may be called *hymenogaſtric*, are carnivorous. All birds of prey belong to this ſpecies. Their ſtomach contains a very powerful juice, capable even of reducing bones to a ſoft ſubſtance, according to Reaumur's experiments; their bile is likewiſe very acrid.—The ſecond, which merit the name of *myogaſtric*, live only upon grain: their ſtomach conſiſts of a quadrigaſtric muſcle, covered with a hard, thick membrane, ſuitable for trituration. Theſe birds have likewiſe a double cæcum.

Fiſhes have a membranous ſtomach, of an oblong form, with a good many appendices: their inteſtines

a

re generally ſhort. They have a liver, but no pancreas.—Reptiles diſplay the ſame internal ſtructure: heir ſtomach is capable of an amazing diſtenſion. Serpents have been often ſeen to ſwallow whole animals, much larger than themſelves.

Inſects have a ſtomach and inteſtines, regularly organized. Swammerdam and Perrault affirm, that a particular ſort of cricket has four ſtomachs;—that is, one arge ſtomach divided into four bags, as appears when he animal is diſſected.—The ſtomach of worms is very rregularly formed: they have alſo ſmall inteſtines.—The polypus ſeems to be nothing but ſtomach; for it igeſts very faſt. The ſame orifice ſerves it both for outh and anus.

The digeſtive organs in all animals conſtantly furniſh fluid for diſſolving the aliments, and converting them nto chyle. This function may be conſidered as a true nimal ſolution.

ARTICLE V.

Of Nutrition.

Nutrition is the conſequence of digeſtion and circulation. As the ſolids are always ſuffering a loſs by he motions which they carry on, they need to be repaired; and this reparation they receive from the function of nutrition.—In the firſt period of the life of the nimal, they grow larger; and the animal increaſes in ſize. The cellular tiſſue is uſually conſidered as the organ of this function, and the lymph as the humour from which the ſolids derive that reparation which they need. It appears, however, that each organ is nouriſhed with a matter peculiar to itſelf, which it ſeparates either from the blood or from the lymph, or from ſome other fluid. The muſcles, for inſtance, are nouriſhed by a fibrous matter which they ſeparate from the blood: the bones extract from it a calcareous phoſphoric ſalt, and a lymphatic matter; the pure lymph dries into plates in the cellular texture: concreſcible oil, depoſited in theſe, produces the fat. Every different part of the body is nouriſhed in a way peculiar to itſelf: the nutrition of each of theſe parts is truly an act of ſecretion. The ſyſtem of the abſorbents ſeems to contribute powerfully to the exerciſe of this function. This function is carried on in quadrupeds and cetaceous animals, preciſely in the ſame way as in man: In birds, ſtill in the ſame way; in fiſhes much ſlower,—and they therefore live very long. In general, the ſlower the nutrition and growth, the longer is the life of the animal.

There is nothing peculiar in the manner in which this function is carried on in inſects. They grow only in the form of larvæ; but not when chryſalides or perfect inſects. Swammerdam and Malphigy have ſhewn that the larva contains the perfect inſect, fully formed, under a number of ſkins;—the caterpillar incloſes the butterfly, with its feet and wings folded.

In worms and polypi, nutrition is carried on in the cellular tiſſue; and in vegetables, likewiſe, by means of the cellular and veſicular tiſſues.

ARTICLE

ARTICLE VI.

Of Generation.

GENERATION, conſidered through the whole animal ngdom, is performed in many various ways. In moſt nera there is a diſtinction of ſexes, and copulation is quiſite for the production of the ſpecies;—ſuch, for ſtance, is the law with reſpect to man, quadrupeds, d cetaceous animals.

The females of quadrupeds have a matrix parted into o cavities, *uterus bicornis*, and a greater number of ts than the female of the human ſpecies: they are t ſubject to the menſtrual flux: moſt of them pro- ce ſeveral young at one time, and the period of their ſtation is commonly ſhorter. Several of them have particular membrane, for receiving the urine of the tus: it is called *allantoides*.

The manner of generation, in birds, is very different. e males have a very ſmall genital organ, not perfora- , and often double. In the females, the vulva is ally ſituated behind the anus: they have ovaria, but matrix, and a duct through which the egg is con- ed from the ovaria into the gut: this duct is called *oviductus*. Phyſiologiſts who have examined the nomena of incubation, have obſerved ſome unex- cted facts with reſpect to the egg, both fecundated, not fecundated. Malphigy and Haller have made the moſt important of theſe diſcoveries. Haller found the pullet fairly formed in eggs not fecundated.

Copulation does not take place among fiſhes. Th female depoſites her eggs on ſand, and the male paſſing over them, impregnates them with his ſeminal liquo which is no doubt neceſſary for their fecundation. Af ter a certain period, theſe eggs burſt, and emit th young fiſhes.

The males of various ſpecies of oviparous quadrupeds have a double or forked organ for generation. Of ſe pents, the viper is the only viviparous ſpecies.

Inſects alone diſplay all the varieties with reſpect t this function that are obſervable among other animals ſome ſpecies exhibit the diſtinction of ſexes among i dividuals,—this, indeed, is the caſe with the greate number: in other ſpecies, reproduction takes place e ther with or without copulation,—as in the vine-frette an inſect of this ſpecies, incloſed by itſelf in a glaſs, p duces a great number of young. M. Bonnet has ful eſtabliſhed the truth of this fact, by a ſeries of expe ments proſecuted with the utmoſt care. The geni organ of male inſects is concealed in the belly. Wh the extremity of that part of the inſect's body is gent preſſed, the organ appears. It is uſually accommod ed with two ſmall arms for holding the female. T ſituation of this organ is very much varied: it is ſom times on the upper part of the belly, near the breaſt,— as in the female of the dragon-fly, *libellula;* at oth times, it is ſituated at the extremity of the antenna,— as in the male ſpider. Inſects multiply prodigiouſ and are almoſt all oviparous, excepting the woo louſe.

Worms are androgynous : every individual poſſeſſes the characteriſtics of both ſexes : and copulation is double,—as may be obſerved of the earth worm and the ſnail.

M. Adanſon adds, that bivalvular ſhell worms are deſtitute of organs of generation, and reproduce the ſpecies without copulation. Theſe worms are viviparous. —Univalvular ſhell worms are oviparous: the young, whether they iſſue from an egg, or immediately from the belly of the mother, have the ſhell ready-formed from their birth.

Polypi are the moſt ſingular animals with reſpect to generation. They produce by ſhooting off ſlips.—When a polypus attains its full growth, it ſhoots out, as it were, a ſmall branch, which is ſeparated from it, and fixes on any contiguous body ; where it continues to grow till it have nearly gained its full ſize. Polypi, in ſhort, are produced from one another, much in the ſame way as branches ſpread from the trunks of trees.

We know only the more apparent phenomena of generation.—All the ſyſtems which have been formed to explain that myſterious operation of nature, are attended with inſuparable difficulties. Accounts of them may be found in Haller's Phyſiology, Maupertuis's *Venus Phyſique*, and Buffon's Natural Hiſtory.—M. Bonnet, in his Reflections on organized Bodies, has ſaid more on this ſubject than almoſt any other perſon.—Buffon's ſyſtem is ingenious, and deſerves to be read.

Through the whole animal kingdom, eggs ſeem to pre-exiſt in the female, and the fecundating liquor of the male only communicates the firſt movement to the heart. The fecundating power of this fluid is ſuch, that when diluted with a large quantity of water, it ſtill retains this property; as is obſervable in the frog.

ARTICLE VII.

Of Irritability.

IRRITABILITY is a property of certain organs, called *muſcles*, by virtue of which they contract when acted upon by the contact of any ſtimulus.—M. Haller has given a very good account of the doctrine of irritability.—The muſcles of man, quadrupeds, cetaceous animals and birds, reſemble each other. They are all equally red, and conſiſt of fibres united in bundles of different forms, covered with ſilver-coloured membranes called *aponeuroſes*, and terminating in flat or round cords called *tendons*.

The muſcles of fiſhes are white, and much more irritable than ſuch as are red.—The muſcles of oviparous quadrupeds and ſerpents are ſtill more irritable; and in theſe animals the irritability remains long after the death of the animal. This laſt property appears to be common to all cold-blooded animals; but thoſe whoſe blood is hot, ſeem to loſe the irritability of their muſcles as it becomes cold.

The muſcles of inſects are within the bones, which are hollow and of a corneous nature. This ſtructure is very diſcernible in the thigh-bone of the great green graſhopper, and alſo in the crab.

The muſcles of worms are very pale and irritable : they are even very ſtrong,—eſpecially in thoſe worms which have a ponderous ſhell to move.

Polypi are very irritable : they contract into a round point; they move their arms with amazing agility, and fold them very readily. Their ſtructure, however, does not appear to be muſcular.

It is their irritability which renders animals capable of moving from one place to another, and performing ſuch motions as are neceſſary, that they may remove hurtful things to a diſtance, and procure what they need. The hiſtory of theſe motions is therefore referable to the hiſtory of this function. Standing and walking, leaping, flying, the pace of reptiles, and ſwimming, are a combination of actions which depend on the muſcular contractions of animals. Were we to enter into a minute detail of them, it would be neceſſary to conſider, in the human ſpecies, with reſpect to ſtanding,—the muſcles which ſerve to extend the thigh; with reſpct to leaping,—the extremities, the form of the body, the length and acuteneſs of the countenance, and the lateral compreſſion of the thorax, in quadrupeds ; with reſpect to flying,—the ſtructure of the feathers, the breaſt-bone, the pectoral muſcles, the bill, the tail, and the interior texture of the bones in birds. It would be no leſs neceſſary to conſider the muſcular rings, and the ſcales or tubercles which reptiles have inſtead of feet ; in fiſhes, the form of the body, the ſtructure of the fins, the ſtructure of the air-bladder, and its communication with the ſtomach ; in inſects, the ſtructure, the number, and the poſition of the legs, the appendices of the tarſi, the form, the poſition, and the nature of the wings, and of thoſe organs which nature has given them to balance themſelves in the air, &c. But it is enough for us at preſent to have pointed out the importance of ſuch reſearches, and that they are highly worthy of the attention of the phyſiologiſt.

Laſtly, there is another conſideration which does not appear to me to have been hitherto properly attended to. Muſcles may be conſidered as organs of ſecretion, intended by nature for the ſeparation of the fibrous and irritable matter of which we have elſewhere ſpoken. The diſorders to which this ſort of ſecretion is liable, ſhould be carefully obſerved by phyſicians. We have already had occaſion to treat of this in our account of the blood.

ARTICLE VIII.

Of Senſibility.

Sensibility is a function, by means of which animals are ſuſceptible of ſenſations of pleaſure and pain, according to the reſpective natures of bodies in contact with their organs. Senſations depend on the brain, on the medulla oblongata, on the the medulla ſpinalis, and numerous nerves which are diffuſed from theſe parts, all over the body: without theſe organs, there could be no ſenſibility. In order the better to explain the nature of this function, we may divide into three regions thoſe organs which appear to form only one whole;

which phyſiologiſts have called the *ſenſible man.* Theſe three are, the brain, comprehending the cerebellum, and the ſpinal marrow,—the nerves diffuſed from theſe parts over the body,—and the ſenſitive expanſion, or dilated extremity of the nerves. This extremity or expanſion exhibits a great diverſity of forms in the different organs: it is ſometimes membranous and reticular,—as in the ſtomach and the inteſtines; ſometimes ſoft and pulpy,—as at the bottom of the eye, and within the labyrinth of the ear. Under the ſkin, on the tongue, on the top of the glans, &c. it takes the form of papillæ; and in other places,—as on the naſal membrane of Schneider, it is ſpread out in long filaments, ſoft and flat.

The brain of the human ſpecies is larger, and better organized than that of any other animal: it is the ſeat of thought. In quadrupeds, it is much ſmaller; but their nerves are more ſenſible; and their ſenſes, particularly the ſenſe of ſmelling, more acute,—the organ of this ſenſe being very much dilated, and, as it were, multiplied, by the number of the ethmoidal plates. The ſkin being thick, and covered with hair, is, on that account, not poſſeſſed of great ſenſibility. The taſte of theſe animals is very delicate.

The brain of cetaceous animals is exceedingly ſmall, in compariſon with the ſize of the body: it is encompaſſed by a thick, oily fluid: their ſenſes are obtuſe.

The brain of birds is not of the ſame ſtructure, nor has it the ſame folds, convexities, and concavities with that of the human ſpecies and quadrupeds. The beautiful ſtructure of the eyes of thoſe animals; their thick and cartilaginous ſclerotica; the *membrana nictitans*, or interior eye-lid, moved by particular muſcles; the bulk of the cryſtalline and vitreous ſubſtances; the bag of black matter, at the extremity of the optic nerve; the brilliant cruſt which coats the choroides;—all theſe together, diſplay a very complicated organization, and ſhew, that nature has taken extraordinary pains to render the powers of viſion of theſe animals keen and piercing; and thus enable them to diſtinguiſh their prey at a diſtance, and avoid the dangers to which they are exposed by the rapidity of their motion in flying: In a word, to favour the agility and activity of motion, which ſeem to be the peculiar prerogatives of theſe animals. Their hearing is not ſo perfect as their ſight. They do not appear very capable of diſtinguiſhing either the taſte or the ſmell of aliments. The ſituation of the noſtrils, and the hard membrane which covers the bill, account for theſe phenomena.

Reptiles have but very little ſenſibility. Their brain is very ſmall: there are no ganglions on their nerves: their ſenſes, in general, appear to poſſeſs but very little activity. Yet Meſſrs Klein, Geoffroy, and Vicq d'Azyr have obſerved the internal ſtructure of both the eye and ear of theſe animals to be extremely beautiful and regular.

The brain, in fiſhes, is very ſmall; and the cranium is filled with a maſs of oily matter. Their ſenſes, eſpecially thoſe of ſight and hearing, are very acute. The conformation of the organ of hearing, in fiſhes, is very regular,—as has been obſerved by Meſſrs Klein, Geoffroy, Camper, and Vicq d'Azyr.—Thoſe naturaliſts who took fiſhes to be deaf, were miſtaken.

Inſects have no brain; but they have a medulla oblongata, of a cylindrical form, and full of knots, which

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runs through the whole length of the body. Nervous filaments ſpread out from this medulla, and accompany the diſtribution of the tracheæ.—Of the organs of ſenſation, none but the eyes are known in inſects. Swammerdam deſcribes an optic nerve, under the cornea of the eyes of inſects that are reticulated, which is there diſtributed into filaments equal in number to the facets of this membrane. We know not whether they have an organ of hearing.

The organs of ſenſation which have been obſerved in worms, are ſcarcely more numerous. Swammerdam found in the ſnail, a brain with two lobes and moveable,—eyes, ſometimes at the baſe, ſometimes on the top of the tentacula,—and an optic nerve, capable of contraction as well as theſe horns. M. Adanſon tells us, that the eyes are ſometimes wanting in worms, or at leaſt covered with opaque ſkin.

As to polypi; they have no organs of ſenſation, and yet they ſeem to have a ſort of predilection for light.

Man, therefore, poſſeſſes the function of ſenſibility in a much more eminent degree than any other animal. This is what peculiarly diſtinguiſhes him, and entitles him to be ranked at the head of the animal creation. —The legiſlator, the philoſopher, and the phyſician ſhould be intimately acquainted with every particular relative to this function.

SUPPLE-

SUPPLEMENT

TO THE

MINERAL KINGDOM.

Of the Nature of Mineral Waters, and the Methods o analyſing them.

AFTER having conſidered all the bodies belonging to the mineral kingdom, and examined their phy-ſical properties, it ſeems proper to introduce, in thi place, the hiſtory of mineral waters; for, as theſe fluid generally hold, in ſolution, terrene, ſaline, and metalli matters, either together or ſeparately, it would have bee impoſſible to make the reader underſtand their natu and compoſition, without making him previouſly ac quainted with the nature of the principles by which they are mineralized. Another advantage ariſing from ou introducing, in this place, the account of mineral wa ters, is, that it may here ſerve as a ſort of recapitulatio of what has been ſaid of minerals in general; as thei principles muſt be taken notice of, in conſidering th manner of analyſing them.

§

§ I. *Definition and Hiſtory of Mineral Waters.*

Waters holding minerals in ſolution, are called *mineral waters*. But as all water, in a natural ſtate, is impregnated, either more or leſs, with ſome mineral ſubſtances, the name, *mineral waters*, ſhould be confined to ſuch waters as are ſufficiently impregnated with mineral matters, to produce ſome ſenſible effects on the animal œconomy, and either to cure or prevent ſome of the diſeaſes to which the human body is liable [*]. On this account, theſe waters might be, with much more propriety, called *medicinal waters*,—were not the name by which they are commonly known too firmly eſtabliſhed by long uſe.

The firſt knowledge which mankind acquired of mineral waters, was, like other branches of human knowledge, obtained by accident. Their having accidentally produced beneficial effects on the health of people who made uſe of them, was, no doubt, the firſt cauſe which occaſioned them to be diſtinguiſhed from common waters. The philoſophers who turned their attention upon them, conſidered only their ſenſible qualities,—colour, gravity or lightneſs, taſte and ſmell. Pliny took notice of a great many different ſorts of water, diſtinguiſhed either by conſpicuous phyſical properties,

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[*] It is to be obſerved, that though waters contain no mineral principles which can be diſcovered by analyſis, they may yet produce ſenſible effects on the animal œconomy. For this purpoſe, they need only to be very light and active, and of an hotter temperature than common water. Such are the waters of Plombieres and Luxeuil, which differ only in temperature from common water.

perties, or by the uſeful effects which they were capable of producing. But it was only in the ſeventeenth century that people began to think of examining the principles diſſolved in theſe waters, by ſubjecting them to chemical proceſſes. Among the firſt who attended to this object, was Boyle, who, in the account of his ingenious experiments on colours, publiſhed at Oxford in the year 1663, mentions various re-agents, which, when poured into water, ſhew, by the alterations which their colours ſuffer, what ſubſtances are diſſolved in the water.—The Academy of Sciences, ever ſince their inſtitution, have been highly ſenſible of the importance of the analyſis of waters; and in the year 1667, Duclos engaged in an examination of the different mineral waters in France. Among the earlier Memoirs of that Society, are the experiments of this chemiſt on thoſe waters. Towards the end of the ſeventeenth century, Boyle engaged, in a more particular manner, in examining mineral waters; and in the year 1685, he publiſhed a work on the ſubject. Boulduc, in the year 1729, publiſhed an account of a proceſs for analyſing mineral waters, greatly preferable to any of thoſe which were commonly in uſe before that period: He directed to evaporate the water under examination; and, during the progreſs of the evaporation, to ſeparate, by a filter, the ſubſtances depoſited.

Various celebrated chemiſts have ſince been ſucceſsful in reſearches into the nature of mineral waters. None of them has failed to make important diſcoveries concerning the different principles contained in thoſe fluids. Thus Boulduc diſcovered in them natrum, the nature of which he aſcertained,—Le Roy of Montpellier,

ier, calcareous muriate,—Margraf, magneſian muriate.—Dr Prieſtley, carbonic acid.—Meſſrs Monnet and Bergman, ſulphurated hydrogenous, or *hepatic*, gas. The two laſt of theſe chemiſts, beſide enriching this department of chemical knowledge with new diſcoveries, have publiſhed complete treatiſes on the proceſſes for the analyſis of mineral waters, and have introduced into it, more accuracy and preciſion, by which it is greatly improved. There are, beſides, many analyſes of particular mineral waters, which have been made by very ingenious chemiſts, and throw much light on this part of experimental knowledge, which is, with good reaſon, conſidered as the moſt difficult branch of chemiſtry. Our limits do not here permit us to enter into a detail of all the information concerning mineral waters to be found in the different works on the ſubject: but we ſhall take care to mention, occaſionally the authors from whom we derive the information which we communicate.

§ II. *Of the Principles contained in Mineral Waters.*

It is only within theſe few years, that all the principles liable to be diſſolved in mineral waters have been certainly known. The reaſon of this may be naturally underſtood to be, that we have only of late acquired the chemical knowledge neceſſary to enable us to determine the nature of thoſe matters, and that their exiſtence could not be aſcertained till the means proper for that purpoſe were adopted. Another reaſon which has retarded the progreſs of ſcience in this department, is, that mineral matters are never found diſſolved in waters but in very ſmall quantities, and a number of them always mixed together; and theſe circumſtances conceal from obſervation the properties by which they are reſpectively diſtinguiſhed. Notwithſtanding theſe and other unfavourable circumſtances, the numerous reſearches of the chemiſts above mentioned, and of others to be hereafter taken notice of, have ſhewn, th ſeveral mineral ſubſtances are very generally found i water; that ſome others are but ſeldom found naturally diſſolved in that fluid; and laſtly, that various mineral ſubſtances are never diſſolved in it at all. Let us however, review the different claſſes of theſe ſubſtances, in the ſame order in which we have already trace their hiſtory.

Siliceous earth is ſometimes ſuſpended in waters; an being then very much attenuated, it is not liable to b precipitated; but the proportion in which it is found always exceedingly ſmall. The carbonated alkali and chalk, perhaps contribute to render ſiliceous ear ſoluble.

Aluminous earth is likewiſe met with in waters. Th extraordinary fineneſs of that earth, which cauſes it be diffuſed all through water, makes it alſo deſtroy th tranſparency of the fluid. Argillaceous waters a therefore foul and whitiſh, and of a pearl or opaline colour: they likewiſe feel greaſy, and have received th name of *ſaponaceous*. The carbonic acid would ſee to favour the ſuſpenſion and ſolution of alumine in water.

Barytes, magneſia, and lime, are never pure in water, but always combined with acids.

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Neither are the fixed alkalis ever found in water, in a ſtate of purity, but often in neutral ſalts.

The ſame is the caſe with ammoniac and moſt of the acids. Yet carbonic acid is often found in waters, in a ſtate of freedom, and poſſeſſed of all its properties: It even characterizes a peculiar claſs of mineral waters, known by the name of *gazeous, ſpiritous, or acidulated waters.*

There are none of the neutral ſalts, with baſes of fixed alkalis often found in ſolution in mineral waters, except ſulphate of ſoda or *Glauber-ſalt*, muriate of ſoda, muriate of potaſh, and carbonate of ſoda. Nitrate and carbonate of potaſh are found but ſeldom.

Sulphate of lime, calcareous muriate, chalk, ſulphate of magneſia or *Epſom ſalt*, muriate of magneſia, and carbonate of magneſia, are more commonly met with in water than any of the other terrene ſalts. As to nitrate of lime and nitrate of magneſia, which ſome chemiſts tell us they have found in mineral waters; theſe ſalts are ſcarce ever found but in ſalt waters, not in mineral waters properly ſo called.

Aluminous neutral ſalts, as well as thoſe which have a baſe of barytes, are almoſt never found in ſolution in waters. Alum or aluminous ſulphate appears to exiſt in ſome waters *.

Pure hydrogenous gas has not been hitherto found in mineral waters.

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* We ſpeak not, here, of the opinion of Givre, and other chemiſts, who thought alum to be one of the principles the moſt prevalent in mineral waters: but of the accurate analyſes by which M. Mitouart diſcovered the exiſtence of alum in the waters of Dominique de Vals, and M. Opoix, in the waters of Provins.

Neither has pure ſulphur been found in theſe fluids: ſometimes, though *but* ſeldom, they contain a ſmall quantity of it in the ſtate of ſulphure of ſoda. But it is moſt frequently ſulphurated hydrogeneous gas which mineralizes ſulphureous mineral waters.

Laſtly, Iron is more commonly found in mineral waters than any other of the metals: It is found in them in two different ſtates,—either combined with carbonic acid, or in union with ſulphuric acid. Some chemiſts have been of opinion, that it may alſo exiſt in waters in a pure metallic ſtate, without any intermediate acid. But as this metal is ſcarce ever found in nature, unleſs in the ſtate of oxide, and in combination with carbonic or ſulphuric acid,—this opinion could never have been adopted, if its authors had not been ignorant of the exiſtence of the former of theſe two acids, and at a loſs to conceive how iron could be diſſolved in water, without the help of the ſulphuric acid. Bergman aſſerts, that both it and mangaueſe are found in ſome waters in union with muriatic acid.

Oxid of arſenic, ſulphate of copper, and ſulphate of zinc, which are found in many waters, communicate to them noxious qualities; and the only reaſon for being at pains to detect any of theſe ſalts in water, is, in order that the water may be carefully abſtained from.

Several authors have admitted the exiſtence of bitumen in mineral waters; but ſcarce any chemiſt now agrees to this. It was the bitter taſte of theſe waters which made them be ſuſpected to contain this oleaginous body. But bitumen is now known not to have any ſuch taſte; and the waters are known to derive it from calcareous muriate.

It is eaſy to imagine, that as water runs through the interior parts of the globe, eſpecially in mountains, it muſt naturally be impregnated with the different ſubſtances here enumerated. The different ſtrata of earth through which waters run, and the extent of thoſe ſtrata, likewiſe ſerve to account for their being more or leſs impregnated with mineral principles, and for the diverſity of the principles found at different times in the ſame waters,—eſpecially if to theſe conſiderations we add, that the various alterations to which our globe is liable, particularly at the ſurface, and in its more elevated parts, muſt often cauſe thoſe fluids to change the direction of their courſe.

§ III. *Different Claſſes of Mineral Waters.*

FROM what has been here ſaid concerning the diffe- nt matters uſually contained in mineral waters, the Reader may perceive, that the claſſes of mineral waters ay be equal in number to the terrene, ſaline, and me- llic matters liable to be diſſolved in the fluid; and of nſequence very numerous. But it is to be obſerved, at no one of the ſubſtances which we have enumerated ever found in waters alone, and unaccompanied with y of the others; and that waters often contain mine- s, to the number of three, four, five, or even more. his is one difficulty unfavourable to a ſyſtematic di- ion of mineral waters, according to the principles ich they contain. Yet by conſidering principally e matter which exiſts in the greateſt abundance in y mineral water, and whoſe properties are the moſt inent, we may form diſtinctions which, though not exceedingly acccurate, will yet ſerve to indicate the nature of any of theſe fluids, and enable us to judge of its virtues. In this way have mineral waters been diſtinguiſhed by the different chemiſts who have engaged in experiments upon them. M. Monnet divides them into three claſſes,—alkaline, ſulphureous, and ferruginous. From late diſcoveries, it appears neceſſary to enlarge the number of the claſſes. M. Duchanoy, who has publiſhed a valuable work upon mineral waters, diſtinguiſhes them into ten claſſes,—gazeous, alkaline, earthy, ferruginous, hot without any mineral, gazeous hot waters, ſaponaceous, ſulphureous, bituminous, and ſaline waters. This author may indeed be blamed for having extended the claſſes of mineral waters to too great a number, as we are unacquainted with either pure gazeous, or pure bituminous waters; yet his diviſion is undeniably the moſt complete, and conveys the moſt juſt ideas of the nature of the various mineral waters; nor could he have adopted any other more ſuitable to his ſubject.

To explain briefly the order in which mineral waters may be arranged according to their principles, and complete what we have already ſaid on this ſubject, we ſhall here propoſe another diviſion of thoſe waters, leſs extenſive, but more regularly ſyſtematic than M. Duchanoy's: in which it is to be obſerved, that we do not include thermal waters, which are merely hot without an addition of any mineral, as the beſt chemiſts conſider theſe as nothing elſe but hot water: neither do we chooſe to include bituminous waters, as there are none really ſuch, known to exiſt in nature.

To us it appears, that all waters may be arranged in four claſſes,—acidulated waters; ſalt waters, ſulphureous waters, and ferruginous waters.

Class I. *Acidulated Waters.*

Gazeous Waters, which may be, with much more propriety, called *acidulated*, are waters in which carbonic acid predominates. They are known by the poignancy of their taſte, and the facility with which they boil, and give out bubbles, even by ſhaking. They redden tincture of turnſole, and precipitate lime-water and alkaline ſulphures. We know of no waters containing this acid, in a pure, inſulated ſtate; and waters of this claſs may therefore be ſubdivided into ſeveral orders, according to the other principles contained in them, or the ſeveral modifications which they diſplay. They all appear to contain either more or leſs of alkali and calcareous earth; but their different degrees of temperature enable us to divide them very naturally into two orders. The firſt of theſe orders may comprehend cold acidulated and alkaline waters, ſuch as thoſe of Seltz, Saint Myon, Bard, Langeac, Chateldon, Vals, &c. Under the ſecond, we may arrange hot or thermal acidulated and alkaline waters,—ſuch as thoſe of Mont d'Or, Vichy, Chatelguyon, &c.

Class II. *Saline or Salt Waters.*

We give the name of *ſaline* or *ſalt waters* to waters holding in ſolution a quantity of neutral ſalts, ſufficiently conſiderable to act in a very diſcernible manner, moſt commonly purgative, on the animal œconomy. It is eaſy to diſcover the theory and the nature of theſe waters: they are preciſely like the ſolutions of ſalts which we prepare in the laboratory; only, they almoſt always contain two or three different ſorts of ſalts. Sulphate of ſoda is very ſeldom found in them: the ſaline principles by which they are generally mineralized are, ſulphate of magneſia or Epſom ſalt, marine ſalt or muriate of ſoda, calcareous muriate, and magneſian muriate, either ſeparately or together. The waters of Sedlitz, Seydſchutz, and Egra, contain Epſom ſalt, which is uſually mixed with muriate of magneſia. The waters of Balaruc contain muriate of ſoda, chalk, and calcareous and magneſian muriate: thoſe of Bourbonne, contain muriate of ſoda, ſulphate of lime, and chalk: thoſe of La Mothe are ſtill more compound than any of the preceding, and hold in ſolution, muriate of ſoda, ſulphate of lime, chalk, ſulphate of magneſia, muriate of magneſia, and an extractive matter. On this head, it is to be obſerved, that ſalts with a baſe of magneſia, are much more common in water than was thought till very lately; and that, in analyſes, they are ſeldom accurately recognized or diſtinguiſhed from calcareous muriate.

Class III. *Sulphureous Waters.*

The name of *ſulphureous waters* has been given t mineral waters appearing to poſſeſs ſome of the prope ties of ſulphur,—ſuch as its ſmell, and its power of c louring ſilver. Chemiſts were long ſtrangers to the tru mineralizer of theſe waters. Moſt of them took it to b ſulphur; but they could never prove the preſence ſulphur,—at leaſt, they could never detect more than

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few particles of it. Thoſe who examined ſome of theſe waters, admitted in them the exiſtence either of ſulphureous ſpirit, or of an alkaline ſulphure. Meſſrs Venel and Monnet were the firſt who objected to this opinion; M. Monnet, eſpecially, came very near the truth, by repreſenting ſulphureous waters as ſimply impregnated with the vapour of *liver of ſulphur*. The younger Rouelle ſays likewiſe, that factitious ſulphureous water may be produced, by ſhaking common water, in contact with air diſengaged by an acid from an alkaline ſulphure. Bergman has greatly improved this doctrine, by examining the properties of ſulphurated hydrogenous gas, of which we ſpoke under the article *ſulphur*. He has proved it to be this gas which mineralizes ſulphureous waters, which he has therefore called, *hepatic* waters; and he gives directions how to diſtinguiſh the preſence of ſulphur.—Notwithſtanding theſe diſcoveries, M. Duchanoy ſpeaking of ſulphureous waters, allows them to contain ſulphure, ſometimes alkaline, ſometimes calcareous, and ſometimes aluminous; and in this he follows the opinion of le Roy of Montpellier, who, as we related under the hiſtory of *ſulphur*, propoſed to form factitious ſulphureous waters from ſulphure with a baſe of magneſia. It appears, that there are actually waters which contain a little ſulphure, and others again mineralized ſimply by hydrogenous gas. In this caſe, ſulphureous waters muſt be diſtinguiſhed into two orders: ſulphureous waters, containing naturally a little alkaline or calcareous ſulphure; and ſulphureous waters, which are only impregnated with hydrogenous gas. The waters of Bareges and Cauterets, and the Bonnes waters, appear to belong to the former of theſe claſſes; while, eaſy to diſcover the theory and the nature of theſe waters: they are preciſely like the ſolutions of ſalts which we prepare in the laboratory; only, they almoſt always contain two or three different ſorts of ſalts. Sulphate of ſoda is very ſeldom found in them: the ſaline principles by which they are generally mineralized are, ſulphate of magneſia or Epſom ſalt, marine ſalt or muriate of ſoda, calcareous muriate, and magneſian muriate, either ſeparately or together. The waters of Sedlitz, Seydſchutz, and Egra, contain Epſom ſalt, which is uſually mixed with muriate of magneſia. The waters of Balaruc contain muriate of ſoda, chalk, and calcareous and magneſian muriate: thoſe of Bourbonne, contain muriate of ſoda, ſulphate of lime, and chalk: thoſe of La Mothe are ſtill more compound than any of the preceding, and hold in ſolution, muriate of ſoda, ſulphate of lime, chalk, ſulphate of magneſia, muriate of magneſia, and an extractive matter. On this head, it is to be obſerved, that ſalts with a baſe of magneſia, are much more common in water than was thought till very lately; and that, in analyſes, they are ſeldom accurately recognized or diſtinguiſhed from calcareous muriate.

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CLASS IV. *Ferruginous Waters.*

As iron is the moſt plentiful, and the moſt liable to alteration of all metals, it is by no means ſurpriſing that water ſhould be eaſily impregnated with it. Accordingly, ferruginous waters are the moſt copious, and the moſt common mineral waters. Modern chemiſtry has thrown much light on this claſs of waters. They were formerly thought to be all ſulphuric. M. Monnet affirms, that ſcarce any of them contain ſulphate of iron; and he is of opinion, that the metal is diſſolved in them without the intervention of any acid.

It is now known, that iron, not in the ſtate of ſulphate of iron, is diſſolved by means of carbonic acid; and thus forms the ſalt which we have denominated *carbonate of iron*. Meſſrs Lane, Rouelle, Bergman, and various other chemiſts, have eſtabliſhed this truth beyond a doubt.— The different proportions of carbonic acid, and the ſtate of iron in waters which owe their virtues to this metal, induce us to diſtinguiſh this fourth claſs into three orders.

The *firſt* comprehends acidulated martial waters, in which the iron is held in ſolution by carbonic acid, and the acid exiſts in ſo large a proportion, as to render them poignant, and ſomewhat ſour to the taſte. The waters of Buſſang, Spa, Pyrmont, Pougues, and La Dominique de Vals are of this order.

The *ſecond* order contains ſimple martial waters, having the iron diſſolved by carbonic acid, without any exceſs of the acid. Thoſe of Forges, Aumale, Condé, and moſt other ferruginous waters belong to this order.—This diſtinction among ferruginous waters was made by M. Duchanoy.

But we may add a *third* order, after M. Monnet.—This order comprehends waters containing ſulphate of iron. Such waters are extremely rare; but there are ſome ſuch. M. Monnet ranks the waters of Paſſy in this order. M. Opoix admits the exiſtence of ſulphate of iron, even in a very conſiderable proportion, in the waters of Provins. M. Fourcy, indeed, denies its exiſtence in them, and imagines the iron in thoſe waters to be diſſolved by carbonic acid: But we cannot yet decide in this caſe; for the reſults of the two chemiſts are directly oppoſite to each other, and a new examination of the waters is therefore requiſite. We may add, that iron is never found alone in waters: it is always mixed with chalk, ſulphate of lime, different muriatic ſalts, &c. But as the metal is the principal baſis of the properties of ſuch waters they are, therefore, according to the principles which we have laid down, to be called *ferruginous waters*[*].

As to ſaponaceous waters, which are admitted by M. Duchanoy, before we can allow their exiſtence, we muſt wait till chemical and medical experiments determine the cauſe of their ſaponaceous properties, which that phyſician thinks owing to alumine, and the effects which thoſe properties enable them to produce on the animal economy, as medicines.

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[*] In this claſſical enumeration of waters, we avoid ſpeaking of ch as contain arſenic and copper; they being conſidered as poiſon- s. We likewiſe paſs over in ſilence, waters containing ammoniacal ts and extractive ſubſtances, produced by the putrefaction of orga- c matters, over which the water has ſtagnated. Waters of theſe ds are not medicinal.—F.

From theſe particulars it appears, that all mineral o medicinal waters are comprehended in nine orders.

Cold acidulated waters.
Hot acidulated waters.
Sulphuric ſalt waters.
Muriatic ſalt waters.
Simple ſulphureous waters.
Sulphurated gaſeous waters.
Simple ferruginous waters.
Ferruginous and acidulated waters.
Sulphuric ferruginous waters.

§ IV. *Examination of Mineral Waters, as diſtinguiſh by Phyſical Properties.*

AFTER mentioning what different matters are fou in waters, and exibiting a ſlight ſketch of the mann in which they may be divided into claſſes and orde according to their principles; we muſt next give account of the proceſſes for analyſing them, and diſti guiſhing, with all poſſible accuracy, what ſubſtanc they contain. This analyſis has been thought the m difficult part of chemiſtry; and with good reaſon; as requires both a familiar knowledge of all the chemic phenomena, and ſkill in conducting chemical operatio In order to aſcertain, with accuracy, the nature of w ter, we muſt, 1. obſerve the ſituation of the ſpring fr which it proceeds, and deſcribe faithfully the neighbo ing grounds, and ſtrata of minerals; and, in order

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diſcover the nature of thoſe ſtrata, it will be neceſſary
o dig trenches, and examine, by a narrow inſpection,
vith what ſubſtances the water is liable to be impregna-
ed. 2. The phyſical properties of the water, its taſte,
ſmell, colour, tranſparency, weight, and temperature,
re next to be examined. Two thermometers, graduat-
d ſo as to riſe and fall as nearly together as poſſible,
vith an aræometer, are requiſite for this purpoſe. Theſe
reliminary experiments ſhould alſo be made in dif-
erent ſeaſons, at different hours of the day, and when
he atmoſphere is in different ſtates. Long continued
ryneſs, or copious rains have a powerful influence on
aters. Theſe firſt obſervations generally ſhew to what
articular claſs the water under examination is to be
eferred, and of conſequence, regulate the remaining
art of the analyſis. 3. Sediments in the bottom of
aſons containing water, ſubſtances ſwimming on its
rface, and ſublimated matters exhaled from it, are
o important objects of obſervation to be neglected. Af-
r this preliminary examination, we may proceed to a-
alyſis properly ſo called, which is performed in three
ays,—by reagents, by diſtillation, and by evaporation.

§ V. *Examination of Mineral Waters by Reagents.*

The name of *reagents* is given to ſubſtances which
e mixed with waters, in order to diſcover, by the phe-
mena which they produce, the nature of the matters
hich thoſe waters hold in ſolution.

The moſt exact chemiſts have always conſidered the
e of reagents as a very uncertain means of diſcover-
g the principles of mineral waters. Their reaſons for
thinking

thinking ſo, are, that the action of reagents never indicates, in an exact manner, the nature of the matters held in ſolution by thoſe waters; and that the cauſes of the changes produced in mineral waters by the mixture of reagents, are frequently unknown: in truth, the ſaline matters employed for this purpoſe, are capable of producing many changes, concerning the nature of which it is very hard to ſay any thing deciſive. Moſt of thoſe therefore, who have engaged in reſearches of this nature have put but little truſt in reagents: they have thought evaporation a much ſurer way of diſcovering the nature and the quantity of the principles of mineral waters. And in the beſt works on the analyſis of theſe fluids it is laid down as a principle, that reagents are to be uſed only as auxiliaries, which, at the utmoſt, only afford grounds for plauſible conjectures concerning the principles by which the waters are mineralized. On this account, only a certain number of reagents are now admitted; and the liſt of thoſe employed by the earlier chemiſts is greatly reduced.

But it cannot at preſent be doubted, that, however gentle the heat neceſſary for the evaporation of waters, yet it muſt produce ſenſible alterations on their principles and change their nature ſo far as to make their reſidue, when examined by chemical proceſſes, afford compounds different from thoſe which were diſſolved in the water. The loſs of the gaſeous matters, which are often among the moſt active principles of mineral waters, occaſions a ſingular change of their nature; and, beſides cauſing ſeveral bodies to be precipitated which owe their ſolubility to the preſence of thoſe volatile ſubſtances, produces a reaction among the other fixed matters

hich alters their properties. The phenomena of the
ouble decompoſitions effected by heat, on com-
ounds which ſuffer no alteration in cold water, cannot
e properly eſtimated, without a long ſeries of experi-
ents; and our ideas concerning them, are therefore
yet but very imperfect. Without entering into a te-
ous detail of particulars, it is enough, that the truth
theſe facts is allowed by all chemiſts, to convince us
at we cannot truſt ſolely to evaporation. But is there
y means of determining the nature of the ſubſtances
ſolved in waters, without having recourſe to the ac-
n of heat? Does the more accurate knowledge of
emical phenomena, which we have derived from the
merous experiments of modern chemiſts, afford any
ceſs by which the errors into which we are liable to
led by the reſults of evaporation, may be corrected?
e particulars which I am about to mention, which
e extracted from a Memoir read by me before the
yal Society of Medicine, will ſhew that very pure
gents, employed in a certain way, may be rendered
ch more ſerviceable in the analyſis of mineral wa-
s than has been hitherto thought.

Among the numerous reagents, the uſe of which has
en propoſed in the analyſis of mineral waters, thoſe
m which moſt advantage may be derived, are, tinc-
e of turnſole, ſyrup of violets, lime-water, pure or
ſtic potaſh, cauſtic ammoniac, concentrated ſulphu-
acid, nitrous acid, pruſſiate of lime, gallic alcohol,
ſpiritous tincture of nut-galls; nitric ſolutions of
rcury and ſilver; paper coloured by the aqueous
cture of fernambouc, which is rendered blue by al-
is; the aqueous tincture of *terra merita*, to which
the

the ſame ſalts communicate a red-brown colout; oxalic acid, for detecting the preſence of even the ſmalleſt poſſible quantity of lime; and barytic muriate, for aſcertaining the preſence of even the moſt trifling quantities of ſulphuric acid.

The effects and the uſe of theſe principal reagents have been explained by all chemiſts; but the particular ſtate in which they are to be uſed has not been ſufficiently attended to. Before employing them, we ſhould carefully make ourſelves acquainted with their nature, that we may not incur miſtakes reſpecting their effects. Bergman has enlarged, at great length, on the effects which they are capable of producing. This celebrated chemiſt tells us, that paper coloured by tincture of turnſole, takes ſtill a deeper colour when expoſed to the action of alkalis, but ſuffers no alteration of colour from carbonic acid. As it is principally with a view to aſcertain the preſence of this acid, that this colouring matter is uſed, he adviſes to employ its tincture only in water, and to dilute it to ſuch a degree as to make it take a blue colour. He abſolutely rejects the uſe of ſyrup of violets, becauſe it is liable to ferment, and is ſcarce ever to be obtained genuine in Sweden. M. de Morveau adds, in a note, that it is eaſy to diſtinguiſh ſyrup coloured by turnſole, by means of corroſive ſublimate, which communicates to it a red colour, but gives to ſyrup of violets a green colour.

Lime-water is one of the moſt uſeful reagents in the analyſis of mineral waters, although few chemiſts have made expreſs mention of it in their works. This fluid decompoſes metallic ſalts, eſpecially ſulphate of iron, the metallic oxide of which it precipitates. It ſeparates a

luminou

minous earth or magneſia, from the ſulphuric, or the
uriatic acids, with which thoſe ſubſtances are often
mbined in waters. It alſo indicates, by precipitation,
e preſence of carbonic acid. M. Gioanetti, a phyſi-
n of Turin, has ingeniouſly contrived to aſcertain,
lime-water, the proportion of carbonic acid contain-
in the waters of St Vincent. This chemiſt, after
ſerving that the bulk of this acid, from which people
ve been in uſe to judge of its quantity, varies with
e temperature of the atmoſphere, mixed nine parts
lime-water with two of the water of St Vincent's.
e weighed carefully the calcareous earth formed by
e tranſition of the carbonic acid from the mineral wa-
into the lime; and found, by Jacquin's ſcale, which
ws thirteen ounces of this acid to be contained in
rty two ounces of chalk,—that the water of St Vin-
t's contains ſomewhat more than fifteen grains. But
lime-water is capable of detaching carbonic acid from
ed alkali, as well as of ſeizing that which is in a diſ-
gaged ſtate; M. Gioanetti, in order to aſcertain ex-
ly the quantity of the latter, performed the ſame
ration with water deprived of its diſengaged acid by
llition. This proceſs may therefore be employed to
ermine, in an eaſy and accurate manner, the weight
he diſengaged carbonic acid contained in any gaze-
mineral water.

ne of the chief reaſons which have induced chemiſts
ay little regard to the phenomena produced by rea-
ts in the analyſis of mineral waters, is, that they
v the exiſtence of various ſubſtances in thoſe waters;
it is then very difficult to diſcern exactly what ef-
they produce. This obſervation chiefly regards pot-

aſh conſidered as a reagent; for this alkali decompoſe all ſalts formed by the union of acids with aluminou earth, magneſia, lime, and metallic matters. When alkali precipitates a mineral water, it cannot be dete mined, merely by inſpecting the precipitate, what is th particular nature of the earthy ſalt decompoſed in th experiment. Its effects are ſtill more uncertain, whe potaſh ſaturated with carbonic acid is employed, as commonly done; for the acid combined with the alk li, then increaſes the confuſion. For this reaſon, I re commend the uſe of very pure cauſtic potaſh; which has, beſides, another advantage over efferveſcent alka li, as it indicates the preſence of chalk, which may b diſſolved in gazeous water by means of an exceſs of car bonic acid. As it ſeizes the acid, the chalk become inſoluble in the water, and is precipitated. I made myſelf certain of this fact, by pouring ſoap-maker's li ivium, recently prepared, into factitious gazeous wat holding chalk in ſolution. The chalk was by degre precipitated, as the cauſtic fixed alkali ſeized the carb nic acid by which it had been held in ſolution. On vaporating this water to dryneſs, after filtration, I o tained carbonate of ſoda, which efferveſced in a ve diſcernible manner with acids. Cauſtic fixed alkali w alſo produce a precipitate in mineral waters, even wh they contain no earthy ſalts. If they contain only alkaline neutral ſalt, leſs ſoluble in its nature than th cauſtic alkali, the latter will then precipitate it as it nites with the water, nearly in the ſame way as alcoh does. M. Gioanetti obſerved this phenomenon in th waters of St Vincent: it is, beſides, eaſy to exhibit by pouring cauſtic alkali into a ſolution of ſulphate

pot

taſh or muriate of ſoda : either of theſe ſalts is ſoon
ecipitated.

Cauſtic ammoniac is, in general, leſs liable to occaſion
iſtakes, when mixed with mineral waters ; for it de-
mpoſes only ſalts having a baſe of aluminous earth or
gneſia, but does not precipitate calcareous ſalts. But
ere are two important obſervations to be made on this
ad. The firſt is, that the ammoniac muſt be very
uſtic, not containing a ſingle particle of carbonic a-
; if not in this pure ſtate, it decompoſes ſalts with a
ſe of lime, by double affinity. The ſecond is, that
s mixture muſt not be left expoſed to the air, when
deſire to know in what manner it acts ſome hours af-
its formation ; for, as has been very properly ob-
ved by M. Gioanetti, this ſalt, in a ſhort time, at-
cts carbonic acid from the atmoſphere, and thus be-
nes capable of decompoſing calcareous ſalts. To re-
ve every doubt concerning ſo important a matter, I
de three deciſive experiments.—After diſſolving in
illed water, a few grains of ſulphate of lime, pre-
ed from tranſparent calcareous ſpar, with very pure
phuric acid, (a precaution indiſpenſibly requiſite,—
Spaniſh white, or chalk, contains both magneſia and
r water), I ſeparated the ſolution into two parts.
o the firſt, I poured a few drops of ammoniac very
ently prepared and very cauſtic. I put this mixture
o a cloſe-ſtopped phial. After eight-and-forty hours,
as clear and tranſparent, without any ſediment ;
decompoſition had, therefore, taken place. The
ond portion was treated in the ſame way, with am-
iac, but put into a veſſel admitting air. At the
of a few hours, there was formed on the upper part

of it, a cloud, which became, by degrees, thicker, and
was at laſt precipitated. The precipitate afforded a live
ly effervefcence with ſulphuric acid, and thereby form
ed ſulphate of lime. The carbonic acid contained i
this precipitate muſt have been ſupplied by the ammo
niac, by which it had been attracted from the atmoſ
phere. This combination of carbonic acid and ammo
niac forms ammoniacal carbonate, capable of decom
poſing calcareous ſalts by a double affinity,—as has bee
ſhewn by Dr Black, M. Jacquin, and ſeveral other che
miſts,—and as any perſon may ſee, on pouring a ſolu
tion of ammoniacal carbonate into a ſolution of ſulphat
of lime, which cauſtic ammoniac does not render turbi
Laſtly, to make myſelf ſtill more certain of the phen
mena of this ſecond experiment, I took the firſt porti
of the water united with the ammoniac; which, ha
ing been preſerved in a cloſe veſſel, had loſt nothing
its tranſparency. I turned the mouth of the phial co
taining it upon a funnel belonging to a very ſm
pneumato-chemical apparatus, and paſſed into this mi
ture, by means of a ſyphon, the carbonic acid gas d
engaged from the effervefcent fixed alkali by the ſ
phuric acid. As this acid paſſed in bubbles throu
the mixture, it becomes turbid, in the ſame way
lime-water on the ſame occaſion. On filtering it, ch
was found on the filter; and ammoniacal ſulphate
obtained by evaporation. The gazeous water, or liq
carbonic acid, produced the ſame decompoſition in
other mixture of ſulphate of lime and cauſtic ammoni
This deciſive experiment fully proves, that it is only
double affinity, and by the addition of carbonic a
that ammoniac decompoſes ſulphate of lime. F

this it appears, that when we need to preſerve a mixture of mineral water with ammoniac, for a few hours, (which is at times neceſſary, as there are ſome earthy ſalts which it decompoſes but very ſlowly), this experiment muſt be performed in a perfectly cloſe veſſel, leſt acceſs of air occaſion a deceitful reſult. This precaution is, in general, highly neceſſary in the uſe of all reagents: Bergman and M. Gioanetti have alſo pointed out the neceſſity of attending to it. I ſhall here add an obſervation concerning the uſe of ammoniac. As it s not eaſy to obtain ammoniac abſolutely cauſtic, and s it is indiſpenſibly neceſſary to have it ſuch in analy-ng mineral waters; a ſimple proceſs may be uſed, of hich I have often found the advantage. Pour a little mmoniac into a retort, having its extremity immerſed the mineral water: heat the retort gently; the am-oniac gas will then be diſengaged, and will paſs, in n highly cauſtic ſtate, into the water. If it produce precipitate, the mineral water muſt certainly contain ther aluminous or magneſian ſalts, or ſulphate of iron: e colour of the precipitate will ſhow the particular na-re of the ſalt. This precipitate moſt frequently con-ts of the chalk which was diſſolved in the water, by eans of carbonic acid. The ammoniac abſorbs that id, and the chalk is then depoſited. It is hard to ſay, om the properties of the earthy precipitate, formed mineral water by cauſtic ammoniac, to which of the o baſes it is to be referred, and whether the neutral t decompoſed, be magneſian or aluminous. But the anner in which it is formed, will indicate its charac-r. On diſſolving ſix grains of ſulphate of magneſia in ur ounces of diſtilled water, and ſix grains of alum in the ſame quantity of this fluid, and cauſing a little ammoniac gas to paſs into each of theſe ſolutions; the former became inſtantaneouſly turbid; but twenty minutes elapſed before the alumine began to be precipitated. Care had been taken to have the phial which contained this mixture very cloſely ſtopped. The ſame phenomena took place with nitrate and muriate of magneſia, and of alumine, diſſolved in an equal quantity of diſtilled water, and treated with the ſame precautions. The rapidity or ſlowneſs with which a mineral water i precipitated by the addition of ammoniac gas, is therefore a criterion by which we may diſtinguiſh the nature of the terrene ſalt which that alkali decompoſes. In general, ſalts with a baſe of magneſia are much more common in water, than ſalts with a baſe of aluminous earth. I muſt not forget to mention a fact related by Bergman: Ammoniac wi form, with ſulphate of magneſia, a compound i which a portion of that neutral ſalt, not decomp ſed, is combined with a portion of ammoniacal ſu phate. Perhaps this undecompoſed portion of the ſu phate of magneſia forms, with the ammoniacal ſu phate, a mixed neutral ſalt, reſembling ammoniac mercurial muriate, or *alembroth ſalt*. Ammoni therefore, precipitates only a part of magneſia, an cannot indicate the exact quantity of *Epſom-ſalt* to whic it ſerves for a baſe. I would therefore prefer lim water for aſcertaining the nature and the quantity ſalts with a baſe of magneſia contained in mineral w ters. It poſſeſſes likewiſe the property of precipita ing ſalts with a baſe of aluminous earth, much m ſpeedily, and in much greater abundance than ammoniac gas *.

Concentrated ſulphuric acid produces a dull white precipitate in water, containing barytes: but as this earth is but very ſeldom found in mineral waters, I paſs to the other effects of this reagent. When it produces bubbles in any mineral water, it indicates the preſence either of chalk, carbonate of ſoda, or pure carbonic acid. The preſence of each of theſe ſubſtances, is diſtinguiſhed by ſome peculiar phenomena. When we heat water, ontaining chalk, after pouring into it ſulphuric acid, here are ſpeedily formed a pellicle, and a ſediment of ulphate of lime; which does not happen on the ſame ccaſion to waters ſimply alkaline. It would, at firſt, ppear, that ſulphate of lime muſt be precipitated as oon as ſulphuric acid is poured into water containing halk: but this very ſeldom happens without the help f heat; as theſe waters generally contain an exceſs of arbonic acid, which promotes the ſolution of ſulphate f lime; and they muſt be deprived of that acid before he ſalt can be ſeparated. Convincing evidence of this ct may be obtained by pouring a few drops of conentrated ſulphuric acid into a certain quantity of me-water, precipitated and afterwards clarified by rbonic acid. If the lime-water contain a good deal

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* The Reader will perceive, that I am repeating ſeveral facts ich have been previouſly mentioned in the courſe of the work. I ve made no ſcruple of doing ſo, in order to render this little treatiſe the analyſis of mineral waters the more intelligible and compleat; d in order to exhibit together, all thoſe principles and facts concern- the proceſſes for analyſing them, which it appears ſo abſolutely eſſary for him to poſſeſs who engages in experiments of this nature.

of regenerated calcareous earth, a precipitate of ſulphate of lime will be formed, either in a few minutes, or more ſlowly, and in proportion as the free carbonic acid is ſeparated. If a precipitate be not formed ſimply by reſt, which happens when the water contains but little ſulphate of lime, and a conſiderable exceſs of carbonic acid, expoſure to a gentle heat will produce in the liquor a pellicle and a precipitate of calcareous ſulphate.

The red nitrous acid is recommended by Bergman for precipitating ſulphur from *hepatized* waters. To prove the certainty of the fact, all that is neceſſary, is, to pour a few drops of this ruddy fuming acid into diſtilled water, into which gas diſengaged by acids from cauſtic alkaline ſulphure has been previouſly introduced, through a pneumato-chemical apparatus. This artificial *hepatized* water, which differs from natural ſulphureous waters in being more highly charged with mineralizing matter, and conſequently liable to be more eaſily decompoſed, affords a precipitate with nitrous acid, in the ſpace of a few moments. This precipitate is of a yellowiſh white colour: when collected o a filter and dried, it burns with the flame and ſmell peculiar to ſulphur, of which it poſſeſſes all the characteriſtic properties. It appears that nitrous acid alters ſulphurated hydrogenous gas, as well as all other inflammable matters, in conſequence of its containing ſuch quantity of oxigene, in that particular ſtate in which i exiſts in it. Scheele has recommended the oxigenate muriatic acid for precipitating ſulphur from theſe ſam waters. Only a very little of it muſt be uſed; for any extraordinary quantity burns the ſulphur, and reduc it to ſulphuric acid, as I have obſerved of the water of Montmorency. The ſulphureous acid precipitates ſulphur from mineral waters with great facility.

No reagent is more imperfectly known, in reſpect to the manner in which it acts, than the alkaline lixivium of blood, called *phlogiſticated alkali*. Chemiſts have long ago obſerved, that this liquor contains Pruſſian blue ready formed. It was thought that this blue might be ſeparated from it by an acid; and it has been propoſed, in this ſtate, as a ſubſtance capable of detecting iron in mineral waters. Nothing can be more uncertain than the compleat ſeparation of pruſſiate of iron from this pruſſiate of potaſh made with blood. It ought therefore not to be employed as a reagent. Macquer, in conſequence of his diſcovery concerning the decompoſition of Pruſſian blue by alkalis, has propoſed the uſe of potaſh ſaturated with the colouring matter of this blue, for the purpoſe of aſcertaining the exiſtence of iron in mineral waters. However, as this liquor ſtill contains a little Pruſſian blue that may be ſeparated by an acid as Macquer has directed, M. Baumé adviſes to add to this Pruſſian alkali, two or three ounces of diſtilled vinegar to the pound, and to digeſt it by a moderate heat till the whole of the Pruſſian blue be precipitated. Pure fixed alkali muſt then be poured in, to ſaturate the acid of vinegar. Notwithſtanding the ingenuity of this proceſs, I have had occaſion to obſerve, that this Pruſſian alkali purified by vinegar, depoſites blue, at the end of a long time,—eſpecially if evaporated. M. Gioanetti made the ſame obſervation, when he evaporated to dryneſs a quantity of Pruſſian alkali purified according to M.

Baumé's

Baumé's directions. He has propoſed two different proceſſes for rendering this liquor more pure, and freeing it of every particle of iron. In the one, he directs to ſuperſaturate Pruſſian alkali with diſtilled vinegar, evaporate it to dryneſs by a gentle heat, diſſolve the maſs remaining in the diſtilled water, and filtrate the ſolution. All the Pruſſian blue remains on the filter and the liquor contains no more of it. The other proceſs conſiſts in neutralizing this alkali with a ſolution of alum, filtrating the liquor, and ſeparating the ſulphate of potaſh by evaporation. Theſe two liquors afford not an atom of Pruſſian blue with pure acids, nor yet by evaporation to dryneſs. Lime-water, ſaturated with the colouring matter of Pruſſian blue, of which I have ſpoken under the article *iron*, does not require all theſe operations. When poured on a ſolution of ſulphate of iron, it inſtantaneouſly forms a pure Pruſſian blue, without any mixture of green. Acids precipitate from it nothing but a few particles of blue. It therefore contains no iron; and is preferable to Pruſſian alkalis for the purpoſe of aſſaying mineral waters. The cauſe of this phenomenon muſt doubtleſs be, that lime diſſolved in water does not act near ſo powerfully on iron as alkalis. This pruſſiate of lime appears to me very proper for detecting iron in ferruginous waters, whether gazeous or ſulphuric. In fact, as the carbonic gas which holds iron in ſolution in waters is of an acid nature, it decompoſes Pruſſian lixivia by double affinity, juſt as well as ſulphate of iron does. I tried pruſſiate of lime on the waters of Spa and Paſſy: I inſtantaneouſly obtained, in that of Spa, a diſcernible blue, and in that of Paſſy, a very copious blue. Here, therefore, is a iquor, which may be very eaſily prepared, and conains no Pruſſian blue ; and is therefore very proper for he purpoſe of indicating the preſence of even the ſmalleſt quantity of iron in waters. It is a ſort of neutral ſalt, formed by the combination of the Pruſſic acid, or he colouring part of Pruſſian blue with lime. I have bſerved, in the hiſtory of iron, that M. Scheele has deluced the ſame inference as I have done, concerning he utility of this reagent ; of which I publiſhed an acount in the year 1780.

Nut-gall, and all ſour aſtringent vegetable ſubſtances, ak-bark, the fruit of the cypreſs tree, the huſks of uts, &c. precipitate ſolutions of iron, and communicate o that metal different colours, according to its quantiy, its particular ſtate, and the ſtate of the water in hich it is diſſolved. There are a vaſt variety of ſhades f this colour, from a pale roſe colour to the deepeſt lack. It is acknowledged, that water's deriving a purle colour from a mixture of tincture of nut-gall, is no roof that iron exiſts in it in a metallic ſtate ; for ſulhate and carbonate of iron likewiſe take a purple coour by the infuſion of nut-gall. It is rather the quanty of the iron, the degree of its adherence to the waer, and the ſtage to which the decompoſition of the ſotion is advanced, to which the diverſities of colour, bſervable in theſe precipitations, are to be aſcribed ; as as been very well obſerved by M. Duchanoy, in his Eſys on the Art of forming Factitious Mineral Waters. We ave formerly mentioned, that the aſtringent principle in ſome meaſure a peculiar acid, as it combines with kalis, gives a red tinge to blue vegetable colours, dempoſes alkaline ſulphures, and combines with metallic

tallic oxides. To aſcertain the preſence of iron in a mineral water, powder of nut-gall, a cold infuſion of the ſame ſubſtance, and a tincture formed from it with alcohol are employed. The tincture is preferred to the other two preparations; being much leſs liable to alteration than the ſolution in water, which ſoon becomes mouldy. What is more ſingular, the products of diſtilled nut-gall likewiſe colour ferruginous ſolutions. The ſolution of it in acids, in alkalis, in oils, or in æther, exhibits the ſame phenomenon. The iron which this matter precipitates from acids is in the ſtate of a gallate of iron: it is a ſort of neutral ſalt, which, though very black, is not ſubject to the attraction of the magnet. It diſſolves ſlowly, and without any perceptible efferveſcence in acids. The action of fire deprives it of theſe properties, and renders it ſubject to attraction. Nut-gall is ſo powerful a reagent, that one drop of its tincture will, in the ſpace of five minutes, colour water containing ſulphate of iron, only in the proportion of one twenty-fourth part of a grain to nearly three pints. All theſe phenomena depend on the matter of the nut-gall being very combuſtible, and readily carrying o from the iron, a portion of its oxigene, ſo as to reduce it to the ſtate of a black oxide or ethiops, of which the ſmalleſt quantity is very perceptible in tranſparent li quors.

The two laſt reagents which we ſhall propoſe to be uſed in examining waters, are the ſolutions of ſilver and mercury in the nitric acid. Theſe ſolutions have been uſed to detect the ſulphuric and the muriatic acid in mi neral waters. But ſeveral other ſubſtances will alſo pre cipitate them, which contain not a particle of either o

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hoſe acids. The white ponderous ſtriæ which the ſolution of ſilver produces in water containing muriate of ſoda, only in the proportion of half a grain to the pint, emonſtrate, in a very ſimple and unequivocal manner, he preſence of the acid of that ſalt: But they do not, n the ſame manner, detect the ſulphuric acid; for, by Bergman's calculation, at leaſt thirty grains of ſulphate f ſoda to the pint, are neceſſary to its producing a ſenſible effect. Add to this, that fixed alkali, chalk, and magneſia, precipitate the nitric ſolution of ſilver in a much more diſtinct manner. The precipitation of a mineral water by this ſolution cannot therefore ſerve to etermine, in a preciſe manner, to what ſaline or earthy ſubſtance its mineralization is owing.

The ſolution of mercury by the nitric acid, is ſtill more liable to occaſion miſtakes. It not only indicates he preſence of the ſulphuric and the muriatic acids in waters, but is alſo precipitated in a yellowiſh powder, by lkaline and earthy carbonates; a property which might ccaſion miſtakes with reſpect to the ſulphuric acid. It is ommonly thought, that the very copious white precipitate which it produces in water, muſt be owing to the reſence of a muriatic ſalt; but mucilages and extractive ſubſtances diſplay the ſame phenomenon,—as is at reſent well known to all chemiſts. Beſides theſe errors nd uncertainties to which we are liable in applying the itric ſolution of mercury to this purpoſe, in conſequence of its producing the ſame precipitate with various ſubſtances, the ſtate of the ſolution itſelf is likely to ccaſion others; of which we need to be aware, in order o avoid ſome blunders of no ſmall conſequence, which e may otherwiſe commit in analyſing waters. Bergman has taken notice of a part of the ſingular diverſities obſervable in this ſolution, in conſequence of its being prepared hot or cold,—eſpecially with reſpect to the colour of the precipitates which it affords by different intermedia: But he has not ſaid a word concerning the property which this ſolution poſſeſſes, of being liable to precipitation by diſtilled water, when highly ſaturated with the mercurial oxide; although M. Monnet had announced this fact in his Treatiſe on the Solution of Metals. As this is a matter of great importance in regard to the analyſis of waters, I therefore engaged in a more particular examination of it, with a view to aſcertain and eſtabliſh, at leaſt ſomething concerning it; and I ſucceeded, as I am about to relate by a very ſimple proceſs. I made a great many ſolutions of mercury in very pure nitric acid, with different proportions of the two ſubſtances, hot and cold; and uſing acids of various degrees of ſtrength. The following were the reſults of my experiments.

1. Solutions prepared cold, are with more or leſs rapidity, charged with a quantity of mercury, which is greater or ſmaller, according as the nitric acid is more or leſs concentrated. But, whatever quantity of mercury a concentrated acid may have diſſolved cold, this ſolution is never precipitated by water. I diſſolved, in cold, two drachms and a half of mercury, in two drachms of red, and highly fuming nitrous acid: the whole weighed in a bottle containing an ounce of diſtilled water, one ounce, four drachms, and five grains. The combination took place with amazing rapidity: more than one fourth of the acid was loſt in very thick nitrous gas, and in aqueous va-

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pours exhaled by the heat of the mixture. This ſolution was of a dark-green colour, and very tranſparent. I poured ſome drops of it into half an ounce of diſtilled water: there were immediately formed ſome whitiſh ſtriæ, which were diſſolved by ſhaking, and did not yield a precipitate. This, however, was the moſt concentrated ſolution that I could prepare in a cold temperature: it diſplayed the moſt conſiderable motion and effervescence, and yielded the largeſt quantity of ruddy vapours. As it had depoſited cryſtals, I added two drachms of diſtilled water, which diſſolved the whole, without exhibiting any appearance of a precipitation. Such, therefore, as are prepared in a cold temperature, with common nitric acid, and half their weight of mercury, can be in no danger of being precipitated by water, and may be confidently employed in the analyſis of mineral waters.

2. However weak the nitric acid, when expoſed over mercury to a conſiderable heat, it diſſolves more of the metal than the ſame acid cold will diſſolve, even in the ſtrongeſt ſtate. The ſolution is of a light yellow colour, and fat and thick: by reſt, it precipitates a yellowiſh ſhapeleſs maſs, which, with boiling water, may be changed into a yellow oxide, or beautiful *turbith*. This ſolution, when poured into diſtilled water, forms a very copious precipitate, of a yellow colour reſembling *turbith*. A ſolution prepared in a cold temperature, will exhibit the ſame reſult, if expoſed to a heat ſo intenſe as to make it exhale a good deal of nitrous gas. Theſe heated ſolutions ſhould not be employed in the analyſis of mineral waters; for they are decompoſed by diſtilled water.

3. The only difference between theſe two ſorts of ſolutions appears to be, that there is a much larger quantity of mercurial oxide in that which is precipitated by water, than in that which is not decompoſable in this fluid. I proved this truth by a comparative evaporation of equal quantities of the two ſolutions, in medical phials, in order to reduce them to red precipitate. I obtained, from the ſolution which is liable to precipitation by water, one-fourth more than from the other. The ſpecific gravities likewiſe afford a criterion by which the reſpective proportions of the oxide of mercury in theſe different liquors may be eſtimated. I compared the weights of equal quantities of three different ſolutions of mercury. One of them, which yielded no precipitate in diſtilled water, and had been formed by the firſt of the above-mentioned operations, weighed one ounce, one drachm, and ſixty-ſeven grains, in a bottle containing an ounce of diſtilled water. The ſecond, which had been prepared by a very gentle heat, communicated a light opaline colour to diſtilled water, without producing any very diſcernible precipitate: it weighed, in the ſame bottle, one ounce, ſix drachms, and twenty-four grains. Laſtly, the third of theſe mercurial ſolutions, which was pretty hot, and precipitated a true turbith mineral, of a dirty-yellow colour in diſtilled water, weighed one ounce, ſeven drachms, and twenty-five grains. I had ſtill one deciſive experiment to make, which might either confirm or refute my opinion. If the ſolution which afforded a precipitate in diſtilled water, owed that property to its containing an exceſs of mercurial oxide; in that caſe, the addition of

more acid might be expected to render it incapable of yielding a precipitate; and this actually happened. On pouring aquafortis into a ſolution which was decomposable by water, it was immediately rendered incapable of yielding a precipitate to that fluid, and reduced into the ſame ſtate with that which is prepared ſlowly, without the application of any greater heat than the temperature of the atmoſphere. M. Monnet has already recommended this proceſs, to preſerve cryſtals of mercurial nitrate from being reduced to oxide by the contact of the air. By a contrary proceſs, and by evaporating a portion of the acid of a good ſolution not ſuſceptible of precipitation by water, it may be reduced to a ſolution containing a much larger proportion of mercurial oxide, and conſequently ſuſceptible of decompoſition by water. It may be reſtored to its former ſtate, by adding a quantity of acid equal to what it has loſt.

Theſe conſiderations appeared to me of importance, in order to render the effects of reagents on water ſomewhat leſs uncertain. But, whatever the accuracy with which we proceed in theſe reſearches, however extenſive our knowledge of the degrees of purity, and the different ſtates of the ſubſtances which are combined with mineral waters, in order to diſcover their principles; if it muſt be acknowledged, that each of thoſe reagents indicates the preſence of two or three different matters; we muſt be always at a loſs to aſcertain the particular nature of the reſults which they at any time produce. Lime, for inſtance, ſeizes carbonic acid: it precipitates both ſalts that have alumine or magneſia for their baſe, and metallic ſalts: Ammoniac produces the ſame effect: fixed alkali precipitates both theſe and calcareous ſalts: calcareous pruſſiate, pruſſiate of potaſh, and gallic alcohol, precipitate ſulphate and carbonate of iron: the nitric ſolutions of ſilver and mercury decompoſe all ſulphuric and muriatic ſalts, however different, or however mingled together in the ſame water:—they are alſo decompoſed themſelves, by alkalis, chalk, and magneſia. Amid theſe complicated phenomena, how is it poſſible to diſcern the peculiar nature of any alteration produced in water by any of thoſe reagents, or to diſtinguiſh, from their operation, whether the water be ſimple or compound?

Theſe queſtions, though very perplexing at a time when chemiſtry was not conſcious of all her ſtrength, may now, however, be diſcuſſed, even with hopes of reſolving them in a ſatisfactory manner.—In the firſt place, I obſerve, that the nature of reagents is much better known than it was a few years ago, and their reaction on the principles of waters much more accurately determined; and, from theſe circumſtances, there is good reaſon to think, that they may now be uſed with much more advantage than has been hitherto imagined. Yet, among the many ſkilful chemiſts who have employed their labours in the analyſis of waters, none but M. Baumé, Bergman, and Gioanetti, have had any idea of the advantages which may be derived from a more liberal uſe of thoſe ſubſtances. Chemiſts have long been in uſe to examine mineral waters by reagents in very ſmall quantities, and commonly in glaſſes: the phenomena of the precipitation produced in this caſe are carefully obſerved, but the experiment is carried no farther. M. Baumé, in his Chemiſtry, adviſes to ſaturate a certain quantity of mineral water which you wiſh to examine, with fixed alkali and acids, to collect the precipitates, and examine their nature. Bergman thinks, that from the weight of the precipitates obtained from ſuch mixtures, the quantity of the mineralizing principles contained in the waters may be eſtimated. Other chemiſts, too, have tried this method; but always with ſome particular views: Nobody has ever thought of making a regular and complete analyſis of mineral waters by this proceſs. To accompliſh it, in my opinion, ſeveral pounds of mineral water ſhould be mixed with each reagent, till the reagent ceaſe to produce a precipitate from the water. It may be left for the ſpace of twenty-four hours in a cloſe-ſtopped veſſel, to depoſite the precipitate;—then filtrate the mixture, and, after weighing and drying it on a ſtove, examine the precipitate which remains on the filter by the uſual methods. Thus you may diſcover, with certainty, the nature of the ſubſtance on which the reagent has acted, and determine the cauſe of the decompoſition which it has produced. Order may be obſerved in theſe operaions, by firſt mixing the watets with thoſe ſubſtances which are leaſt capable of altering them, and proceedng to the application of ſuch ſubſtances as may produce on them a greater variety of changes, and thoſe moſt difficult to eſtimate. I uſually proceed in the folowing manner in this ſort of analyſis. After examinng the taſte, colour, weight, and all the other phyſical properties of a mineral water, I pour four pounds of ime-water on an equal quantity of the fluid which I m examining: if no precipitate is formed in the ſpace f twenty-four hours, I am ſure that the water contains neither free carbonic acid, alkaline carbonate, neutral ſalts with a baſe of aluminous earth or magneſia, nor metallic ſalts. But when a precipitate is either inſtantaneouſly or gradually formed, I filtrate the mixture, and examine the chemical properties of the ſediment. When the ſediment has no taſte, is inſoluble in water, effervefces with acids, and forms with the ſulphuric acid an inſipid ſalt, almoſt inſoluble in water; I conclude that it is chalk, and that the lime-water has taken up no principle but carbonic acid from the mineral water. Again, when the precipitate is but ſcanty, is not readily depoſited, produces no effervefcence, and affords with ſulphuric acid a ſtyptic, or bitter, and very ſoluble ſalt, it muſt then conſiſt of magneſia or aluminous earth, or poſſibly of both. I need not here enlarge upon the means for diſtinguiſhing between theſe two ſubſtances; they muſt be already well known. I ſhall only add, that ſuch a variety of thoſe means may be uſed, as to leave no doubt with reſpect to the nature of the ſubſtance precipitated.

After this proceſs of examination with lime-water, I pour on the ſame mineral water one or two drachms of very cauſtic ammoniac, or introduce into it ammoniac gas, diſengaged from that liquid ſalt by heat. When the water is ſaturated, I leave the mixture to reſt in a cloſe veſſel for four and twenty hours: If I then find a precipitate formed, as it can be owing only to either ferruginous ſalts, or to ſalts with a baſe of magneſia or alumine, I examine its nature by the different operations mentioned above, under the account of the trial by lime. But as ammoniac gas does not act in ſo uniform a manner as lime-water, which effects the ſame decomoſitions, it is proper to obſerve that this gas is to be mployed only as an auxiliary, from which ſuch accu- ate reſults are not to be expected as from the operation f the preceding reagent.

After the ſalts with a baſe of aluminous earth or mag- eſia, have been diſcovered with lime-water or ammoni- as; potaſh or ſoda will detect thoſe having a baſe of me, ſuch as calcareous ſulphate, and calcareous muri- e. With this view I precipitate a few pounds of the ater which I examine, with either of theſe fixed alka- in liquor, till ſuch time as the water ceaſe to be tur- d. As the alkali decompoſes ſalts having a baſe of uminous earth, as well as thoſe which owe their for- ation to lime;—if the precipitate reſemble that which btained by the application of lime-water, in form, lour, and quantity, I preſume that the water contains calcareous ſalt; and this conjecture is uſually con- med by a chemical analyſis. But when the mixture comes much more turbid than that which was form- with lime-water, and when the ſediment is more nderous and copious, and ſooner depoſited; I then er, that it contains lime with a mixture of magneſia, alumine. I aſcertain this, by treating the ſediment the different operations for the purpoſe, already de- ibed. It may be naturally conceived, that the iron cipitated by reagents, at the ſame time with the ſa- o-terrene ſubſtances, muſt be diſtinguiſhable by its our and taſte, and that the quantity of the metal ſe- ated by theſe proceſſes, muſt be too ſmall to have influence on the reſults.

I need not here explain what ſubſtances the ſulphu- acid, the nitrous acid, nut-gall, and calcareous and alkaline pruſſiates, are capable of precipitating, when uſed as reagents. What I have ſaid above on the general effects of theſe matters, may be conſidered as ſufficient. I ſhall only add, that when mixed in a large proportion with mineral waters, they produce precipitates, from an examination of which we may aſcertain the nature and the proportions of their principles; a proceſs which has been performed by Meſſrs Bergman and Gioanetti.

A conſideration of the products which nitric ſolutions of ſilver or mercury produce in mineral waters, will detain us longer. Theſe are the beſt reagents for examining large quantities of water, when we wiſh to aſcertain the nature of the acids which waters may contain. Mineral waters may be conſidered as completely analyſed, when the acids which they contain are known: for the acids are generally combined with ſome of the baſes liable to be detected by the preceding reagents. The colour, form, and quantity of the precipitates formed by ſolutions of mercury and ſilver, have hitherto been regarded by chemiſts as indicating ſufficiently the nature of the acids to which their formation is owing. A thick, weighty ſediment, inſtantaneouſly formed, indicates the preſence of the muriatic acid. If ſcanty, white, and cryſtallized, with nitrate of ſilver,—yellowiſh and ſhapeleſs with nitrate of mercury, and in both inſtances but ſlowly depoſited, it is then to be aſcribed to ſulphuric acid. However, as theſe two acids are often found together in the ſame water, and as alkali and lime likewiſe decompoſe theſe ſolutions, the reſults are rather uncertain, unleſs we attend at the ſame time to the phyſical properties of the precipitates. They muſt, therefore, be examihed in a more particular manner. To this end, mix the ſolutions of ſilver and mercury with five or ſix pounds of the water which you wiſh to analyſe; at the end of twenty-four hours, filtrate the mixtures, dry the ſediments, and then treat them with the uſual proceſſes. On heating in a retort the precipitate produced by the nitric ſolution of mercury, the portion of that metal which combines with muriatic acid, volatilizes into mild mercury; and that which is combined with ſulphuric acid, remains at the bottom of the veſſel, and is of a reddiſh colour. Theſe two ſalts may be likewiſe diſtinguiſhed from each other, on this occaſion, by the phenomena which they exhibit on burning coals. Sulphate f mercury exhales ſulphureous acid, and takes a red colour; mercurial muriate remains white, and is volatilized without diffuſing any ſmell of ſulphur. Theſe phenomena likewiſe ſerve to enable us to diſtinguiſh ſuch precipitates as may be formed by alkaline ſubſtances contained in waters; for alkaline ſubſtances never give ut a ſulphureous ſmell, nor are they volatile without decompoſition.

The precipitates produced by the combination of mineral waters with the nitric ſolution of ſilver, may be xamined with the ſame facility. Sulphate of ſilver is ore ſoluble than muriate of ſilver; and theſe two ſalts e therefore ſeparable by diſtilled water. Muriate of lver may be diſtinguiſhed by its fixity and fuſibility, d ſtill more readily by its being leſs decompoſable than lphate of the ſame metal. Sulphate of ſilver, when t upon coals, exhales a ſulphureous ſmell, and leaves oxide of ſilver, which may be melted without any dition. I am not to ſpeak here of all the chemical proceſſes which might be adopted to diſtinguiſh between and to ſeparate theſe two ſalts of ſilver. It is enough, that ſome of them are here deſcribed.

§ VI. *Examination of Mineral Waters by Diſtillation.*

DISTILLATION is uſed in the analyſis of mineral waters, to diſtinguiſh the gaſeous ſubſtances which they may happen to contain. Thoſe ſubſtances are either air, more or leſs pure, or carbonic acid, or ſulphurated hydrogenous gas. To diſtinguiſh the nature and the quantity of the gaſeous ſubſtances contained in any mineral water, take a few pounds of the water, and put them into a retort of ſuch a ſize that they may fill it only one half or two thirds full. To this veſſel adapt a curve tube, entering by its other end, into a glaſs filled with mercury. When the apparatus is thus diſpoſed, heat the retort till the water fairly boil, or till elaſtic fluid ceaſe to paſs into the glaſs containing the mercury. When the operation is ended, abſtract from the bulk of the gas obtained, the air that was contained in the empty part of the retort. The reſt is the aëriform fluid that was contained in the mineral water, the nature of which may be ſoon known, by trying it with a lighted lamp, or tincture of turnſole, or lime-water. If it take fire, and emit a fetid ſmell, it is ſulphurated hydrogenous gas: If it extinguiſh a taper, redden turnſole, and precipitate lime-water, it muſt be carbonic acid: Laſtly, if it maintain combuſtion without exhibiting flame, if it be inodorous, and if it alter neither turnſole nor lime-water, it is then atmoſpheric air. The atmoſpheric air thus obtained from mineral waters may happen to be purer than the common air of the atmoſphere. We can then judge of its purity from the manner in which it contributes to combuſtion, or by mixing it with nitrous or hydrogenous gas in Meſſrs Fontana and Volta's eudiometers. The proceſs employed to obtain gaſeous matters from mineral waters, is entirely the invention of modern chemiſtry. Formerly, they for this purpoſe uſed a wet bladder, which was fitted to the mouth of a bottle full of mineral water. The fluid was then ſhaken; and from the manner in which the bladder was ſwelled, an idea was formed of the quantity of gas contained in the water. We know, at preſent, that this operation is not to be depended upon; for water never gives out all its gas without ebullition; and the ſides of a wet bladder alter the elaſtic fluid which is obtained, and deſtroy its nature. It is not neceſſary to take notice, that the phenomena which take place in the water, when gas is ſeparated, ſhould be carefully obſerved; and that when the taſte, the lightneſs, and the ſparkling of the water, ſhew it to contain a large proportion of gas, the quantity of it ſubmitted to diſtillation ſhould then be proportionably ſmaller.

Such is the operation recommended by modern chemiſts for the extracting of elaſtic fluids from waters. I ſhall obſerve, 1. That with reſpect to acidulous waters, this proceſs cannot be depended upon, without a very accurate calculation of the weight of the air,—and the degree of preſſure to which the elaſtic fluid is expoſed in the glaſſes;—and that, as it is very difficult to eſtimate theſe with ſufficient accuracy, the abſorption of this acid by lime-water, as has been propoſed by M. Gioanetti, appears preferable. 2. Though it be recommended by

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Bergman for the extracting of ſulphurated hydrogenou gas from ſulphureous waters, it will not anſwer this end; for boiling heat decompoſes this gas; and it is likewiſe decompoſed by mercury, which paſſes into the ſtate of æthiops, as ſoon as it comes into contact with this elaſtic fluid. On this account, in my analyſis of the waters of Enghien, near Montmorency, I have propoſed the uſe of litharge for the abſorption of this gas in cold ſtate, and for purifying ſulphureous waters fro all the ſulphur which they contain.

§ VII. *Examination of Mineral Waters by Evaporatio*

Evaporation is generally conſidered as the mo certain mode of obtaining all the principles contained mineral waters. We have above obſerved, what may here repeat, from the experiments of Meſſrs Ve and Cornette, that long boiling may happen to deco poſe ſaline matters diſſolved in waters; for which reaſo we have rather recommended the uſe of reagents. vaporation, however, affords ſo much additional info mation, when employed together with the analyſis reagents, that it will be proper to give a particular count of the beſt method for conducting it.

As the purpoſe of this operation is, to obtain the ed principles of mineral water, it is evident, that in der to diſtinguiſh the nature and proportion of th principles, a certain quantity of the water muſt be mitted to the operation; and accordingly, the weak the proportion in which thoſe principles exiſt in the ter, ſo much the more of that fluid ſhould be Twenty pounds of the water may be ſufficient, whe

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contains a good deal of ſaline matter. But when only a very ſmall proportion of ſuch matter appears to be diſſolved in it, a much larger quantity muſt be evaporated; at times, even no leſs than ſome hundred pounds. The nature and ſhape of the veſſels in which mineral waters are expoſed to evaporation, are not matters of indifference. Thoſe made of any metal, except ſilver, are liable to be altered by water: glaſs veſſels, again, of a certain ſize, are very likely to crack or ſplit: veſſels of very compact and well varniſhed earth, are the moſt ſuitable for this purpoſe, although, when the varniſhing cracks, they are liable to abſorb the ſaline matters. Veſſels of porcelain, without a coating, would, no doubt, be the moſt anſwerable; but theſe again are too dear. Chemiſts have propoſed different methods of evaporating mineral waters. Some adviſe to diſtil them to dryneſs in cloſe veſſels, that no extraneous ſubſtances from the atmoſphere may mix with the reſidue; but this operation is too tedious. Others recommend evaporation by a moderate heat, not ſufficient to make them boil; as a boiling heat is believed to alter their fixed principles, and to deprive them always of a certain part of thoſe principles. This is the opinion of Venel and Bergman. M. Monnet, on the contrary, would have us to boil the water; as its motion, when boiled, prevents extraneous matters to inſinuate themſelves from the atmoſphere. Bergman, to avoid this inconvenience, directs us to cover the evaporatory veſſel with a lid having a hole in the middle, through which the vapours may make their eſcape. This laſt method greatly retards the evaporation, as it diminiſhes the ſurface of the fluid in ſo conſiderable a degree. It may be employed, at firſt, till the vapours become ſtrong enough to remove the duſt. But the chief difference among chemiſts, i reſpect to the mode of conducting this operation, i that ſome follow Boulduc in ſeparating the ſubſtances which are depoſited as the evaporation goes on, in orde to obtain each of the principles of the water in a pure inſulated ſtate; whereas others would have the evapo ration carried on to dryneſs, before any ſuch ſeparatio be attempted. I agree with Bergman, in thinkin this laſt method the moſt expeditious and the moſt ce tain: for whatever be the precautions adopted in fol lowing the former method, in ſeparating the differen matters as they are depoſited or cryſtalliſed, they ar never obtained pure, but always need to be examine by a farther analyſis. Beſides, this method is neve exact, on account of the loſs occaſioned by ſo ma filtrations: laſtly, it is very difficult and perplexing, a renders the evaporation exceedingly tedious. Minera waters ſhould then be evaporated to dryneſs in gla capſules, on a water-bath: it would be ſtill better to u glaſs retorts on a ſand-bath.

During the courſe of this evaporation, different ph nomena are obſerved. When the water is acidulous, i appears full of bubbles, as ſoon as the heat begins t make an impreſſion upon it: while the carbonic acid i diſengaged, a pellicle and a ſediment are formed, co ſiſting of chalk and carbonate of iron: after the forma tion of theſe pellicles, there is a cryſtalliſation of ſu phate of lime: laſtly, muriates of potaſh and ſoda ar cryſtalliſed in cubes on the ſurface; and, to obtain th deliqueſcent ſalts, the evaporation muſt be continued t dryneſs.

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Let the reſidue then be weighed, and put into a
mall phial, with three or four times its weight of alco-
ol. Shake the whole, and after letting it reſt for a
ew hours, filtrate it; preſerve the liquor apart, and
ry, by a gentle heat, or in the air, that portion of the
eſidue on which the ſpiritous fluid has not acted. When
fficiently dry, it is to be carefully weighed; and the
ſs which it has ſuffered ſhews what quantity of calca-
eous or magneſian muriate it contained, as theſe ſalts
e very ſoluble in alcohol. We will ſpeak afterwards
f the method of aſcertaining the exiſtence of theſe two
lts in this ſpiritous fluid.

The reſidue, when properly dried, is next to be dilut-
d with eight times its weight of cold diſtilled water;
d this mixture, after being left to ſettle for ſeveral
urs, muſt be filtrated. The reſidue is again dried,
d then boiled half an hour in four or five hundred
mes its weight of cold diſtilled water. It is next to be
ain filtrated; and after this laſt operation, there re-
ains only what the cold water and the boiling water
ve been inſufficient to diſſolve. The cold water
ould take up the neutral ſalts, ſuch as ſulphate of ſo-
a or magneſia, muriate of ſoda or potaſh, and fixed al-
lis, eſpecially ſoda combined with carbonic acid.
iling water in a large proportion, diſſolves only ſul-
ate of lime. There are therefore four ſubſtances to
e examined after theſe different operations on the mat-
r obtained by evaporation: 1. The reſidue which is
ſoluble in alcohol, and in water in different tempera-
res: 2. Salts diſſolved in alcohol: 3. The ſalts which
ve been taken up by the cold water: 4. Laſtly, Thoſe
hich have been taken up by the boiling water. We

now proceed to the experiments for diſtinguiſhing theſe different ſubſtances.

1. The reſidue which has withſtood the action of alcohol, and of cold and hot water, may conſiſt of calcareous earth, of carbonate of magneſia and iron, of alumine, and of quartz. The two laſt of theſe ſubſtances are very rarely to be found in waters, but the three firſt are very common. A lighter or deeper brown or yellow colour, indicates the preſence of iron. When the colour of the reſidue is a light grey, it contains no iron. When it contains any of that metal, Bergman adviſes to moiſten it, and expoſe it to the air till it ruſt. Vinegar then no longer acts upon it. To explain the methods for ſeparating theſe different matters, let us ſuppoſe an inſoluble reſidue, conſiſting of all the five ſubſtances which we have allowed that it may contain. We muſt begin with moiſtening and expoſing it to the rays of the ſun. When the iron is ſufficiently ruſted, the reſidue may be digeſted in diſtilled vinegar. This acid diſſolves the lime and magneſia. By evaporating the mixture, we obtain calcareous acetite, which is diſtinguiſhed from acetite of magneſia by not attracting moiſture from the atmoſphere. Theſe two ſalts may be ſeparated by deliqueſcence, or rather by pouring ſome ſulphuric acid into the ſolution containing them. The ſulphuric acid forms ſulphate of lime, which is precipitated: if there were any magneſian acetite, the ſulphate of magneſia, formed by the ſulphuric acid, would remain diſſolved in the liquor, and might be obtained by an evaporation judiciouſly conducted. To aſcertain the quantity of the magneſian and calcareous earths contained in this reſidue, precipitate the

ulphates of lime and magneſia formed by the ſulphuric
cid poured into the acetous ſolution with carbonate of
otaſh, and weigh the precipitates. When the chalk and
agneſia of the reſidue are ſeparated, only iron, alu-
ine, and quartz remain. The iron and alumine are
etached by means of pure muriatic acid, which diſſolves
oth theſe ſalts. The iron is precipitated by pruſſiate
f lime, and the alumine by carbonate of potaſh : the
wo ſubſtances are then weighed to determine the quan-
ities. The matter which remains after the ſeparation
f the alumine and the iron, is uſually quartzoſe. Its
uantity is aſcertained by weighing it ; and its nature,
y melting it with carbonate of ſoda, by means of the
low-pipe. Theſe are the moſt accurate proceſſes which
ave been recommended by Bergman, for the exami-
ation of the inſoluble reſidue of mineral waters.

2. The alcohol which was uſed in waſhing the dry
eſidue of the waters, is next taken and evaporated to
ryneſs. Bergman directs to treat it with ſulphuric acid
iluted in water, in the ſame manner as the acetous ſo-
ution above taken notice of. But it is to be obſerved,
hat by this proceſs only the baſe of thoſe ſalts is diſco-
ered. To determine the nature of the acid, which is
ſually united with magneſia or lime, and ſometimes
ith both in this reſidue, we muſt pour upon the dry
eſidue a few drops of ſtrongly concentrated ſulphuric
cid, which produces an efferveſcence, and diſengages
uriatic acid gas, that makes itſelf known by its ſmell
nd white vapour, when the ſalt under examination
wes its formation to that acid. Its exiſtence may like-
iſe be aſcertained, by diſſolving the whole reſidue in
ater, and mixing with it a few drops of the nitric ſo-

lution of ſilver. With reſpect to the baſe, which, as we have already mentioned, conſiſts either of lime or of magneſia, or of both; the quantity and the nature of its principles may be alſo determined by ſulphuric acid, by the ſame proceſs which has been explained above in ſpeaking of the application of the acetous acid.

3. The lixivium of the former reſidue of the mineral water, prepared with eight times its weight of cold diſtilled water, contains alkaline neutral ſalts,—ſuch as ſulphate of ſoda, muriates or marine ſalts, carbonate of potaſh or ſoda, and ſulphate of magneſia. Sometimes, too, there is a ſmall quantity of ſulphate of iron. Theſe ſalts never exiſt altogether in mineral waters. Sulphate of ſoda and carbonate of potaſh, are but very ſeldom found in mineral waters; but marine ſalt is often found in them, in union with carbonate of ſoda. Sulphate of magneſia likewiſe exiſts pretty often in ſuch waters; and they are even ſometimes found to contain it in a pretty conſiderable quantity. When this firſt waſhing of the reſidue of a mineral water contains only one neutral ſalt; that ſalt may be very eaſily obtained by cryſtalliſation, and its nature may be known by its form and taſte, and by the manner in which it is affected by fire and reagents. But this caſe is very rare; and it happens much more frequently, that a number of ſalts are united together in this lixivium: We muſt then endeavour to ſeparate them by ſlow evaporation. Even this method does not always fully ſucceed, with whatever care this firſt lixivium may be evaporated: each of the ſalts obtained at different times by evaporation, muſt be examined anew. It is moſt commonly carbonate of ſoda which is depoſited in a confuſed manner among the

muriati

riatic ſalts. Theſe may be ſeparated by a proceſs ſcribed by M. Giaonetti: It conſiſts in waſhing this xed ſalt with diſtilled vinegar;—that acid diſſolves the bonate of ſoda: Dry the mixture, and waſh it anew h alcohol;—the alcohol takes up the acetite of ſoda, hout acting upon the marine ſalt: Evaporate the ſpi- us ſolution to dryneſs, and calcine the reſidue;—the egar is decompoſed and burnt. Nothing remains after but ſoda, the exact quantity of which is known.

. The lixivium of the former reſidue of mineral wa- prepared with four or five times its weight of boiling er, contains nothing but ſulphate of lime. Accord- y, pure cauſtic ammoniac produces no change upon but cauſtic potaſh forms in it a copious precipitate. evaporating the lixivium to dryneſs, the quantity of ene ſalt which it contains is exactly known.

§ VII. *Of Factitious Mineral Waters.*

HE proceſſes which have been deſcribed for the ex- ation of the reſidues obtained by the evaporation of eral waters, are ſufficient for diſcovering, with the oſt accuracy, whatever different ſubſtances may be lved in thoſe fluids. Yet we muſt ſtill advance a farther, in order to confirm the reſults of our ana- : We muſt imitate nature by a ſynthetic proceſs, diſſolve in pure water the ſeveral ſubſtances obtained nalyſis, from the mineral water which we have been ining. If the factitious mineral water thus formed, the ſame taſte and weight, and exhibit the ſame omena with reagents as the natural mineral water h was analyſed,—no fuller proof can be required

of the accuracy of the analyſis. Such artificial comb
nations happily ſupply, at all times, in all places, and
a ſmall expence, medicines equally uſeful for the cure
diſeaſes, with natural mineral waters, whoſe properti
are liable to be altered by conveyance from one place
another, and by many other circumſtances.

The moſt celebrated chemiſts are of opinion, that
tural mineral waters may be imitated by art. Macqu
obſerves, that ſince the diſcovery of the carbonic ac
and ſince its power of rendering a great many ſubſtan
ſoluble in water has been taken notice of, it is becom
much eaſier to prepare factitious mineral waters. Berg
man has given directions for the preparation of factitio
Spa, Seltz, Pyrmont, &c. waters. In Sweden, he inform
us, ſuch waters are uſed with great ſucceſs; and
himſelf had experience of their good effects. M. D
chanoy has publiſhed a work, in which he gives a ſeri
of proceſſes for the artificial preparation of all the mi
ral waters uſed in medicine. We have therefore g
reaſon to hope, that chemiſtry may render the art
medicine ſome important ſervices, by ſupplying ſo
valuable medicines, and by weakening and increaſi
their energy at pleaſure.

A

DISCOURSE

ON

MODERN* CHEMISTRY *in General, and on its* FIRST PRINCIPLES.

N tracing the hiſtory of chemiſtry for theſe laſt twenty years, we find, that, in conſequence of the diſco- y of the different elaſtic fluids, and their properties, hl's theory has loſt much of its credit: Chemiſts ve been for ſome time in doubt, whether to reject or ere to it, and have formed various theories,—the mber of which is ſcarce inferior to that of thoſe who ſeriouſly engaged in the purſuits of this ſcience. A d many chemiſts. however, eſpecially in the north, e not yet adopted any new theory, but continue onnect the theory of Phlogiſton with the newly diſ- ered facts. But thoſe who are maſters of the nce in all its extent, muſt readily perceive, that the nner in which that connection is formed, is far from g natural or ſatisfactory; and that it conſiſts of for- analogies, the inconſiſtency of which is ſufficiently ing.

hc doctrine adopted by ſeveral French chemiſts, at head of whom we muſt rank M. Lavoiſier, who contrived and laid the foundations of this ſyſtem, is not ſubject to the ſame difficulties. Its ſimplicity, its ſyſtematic progreſs, its perſpicuity, and the eaſe with which it is applicable to all the phenomena of chemiſtry, render it much ſuperior to any of thoſe which ſtill divide ſuch of the philoſophers of Europe as have not adopted it. Among the more celebrated of its partiſans, this doctrine now boaſts of the names of Lagrange, la Place, Black, Kirwan, Van Marum, Bertholet, Monge, Morveau, Chaptal, Charles, Landriani, Schurer, Girtanner, Jacquin the ſon, Arezula, &c. &c. I have taught this doctrine both in my public and private lectures for theſe laſt twelve years. If I might flatter myſelf with having contributed in any degree to elucidate this ſyſtem of modern chemical ſcience, either by my lectures and writings, or by ſuch diſcoveries as I have publiſhed within theſe fifteen years, I muſt be permitted to obſerve, that no other theory affords ſo true and full an explanation of all the phenomena of nature and of the arts. This doctrine has been particularly explained through the whole of this work: But perhaps a ſhort view of it may ſtill be of uſe to the ſtudent; and I have therefore endeavoured to exhibit, in the following Diſcourſe, a brief account of the principles on which it is founded; which may render it more ſtriking, and more eaſily intelligible, and which will accordingly be a ſort of abſtract of all the leading phenomena, to which the others may be referred as to ſo many general heads.

In all chemical experiments, one of the two following phenomena is obſerved: 1. Heat is either diſengage

gaged or fixed: 2. An elaſtic fluid is either formed
r abſorbed. After theſe two general facts are eſta-
liſhed as invariably certain, it may be naturally con-
eived, that the properties and action of heat, with the
ormation and fixation of elaſtic fluids, are the founda-
ion of the theory of chemiſtry. Theſe, therefore,
re the two great objects which muſt here engage our
ttention.

f Heat, and of the Formation and Fixation of Elaſtic Fluids.

ALTHOUGH the weight, both of ſenſible heat, and
combined or latent heat, which we have denomi-
ted *caloric*, is at preſent unknown, and cannot
erefore afford any proof of its material or individual
iſtence, yet the whole phenomena of chemiſtry con-
r to prove, that it exiſts as a ſeparate body or ſub-
nce, poſſeſſes certain unvarying properties or charac-
riſtics, and is uniformly ſubject to certain laws of
inity, Beſides its power to produce, by its action
our organs, that ſenſation which we denominate
at, philoſophers have obſerved it to poſſeſs certain
inctive properties which can belong to no other
ſtance, ſuch as rarefaction, or the ſeparation which
t produces of the component particles of all na-
al bodies; which, by increaſing their bulk, dimi-
hes their reciprocal attraction, and, without en-
ging the maſs, diminiſhes, in the ſame propor-
n, their ſpecific gravity, and ſtrengthens the affini-
between the component particles of different bo-

dies. The greater the quantity of caloric accumulated in any body, the more it is compreſſed and condenſed in that body; ſo much the more is its affinity for that body increaſed; and in the ſame proportion too, are the properties of the body changed. Fuſion or liquefaction, volatilization or ſublimation, the paſſage of liquids into the form of vapours or elaſtic fluids, —are effects conſtantly produced by the penetration of heat into thoſe bodies, or rather by its combination with them. Ice, or water in a ſolid ſtate, becomes fluid by abſorbing a certain quantity of caloric: A larger proportion of the ſame principle renders it inviſible and aëriform. There can be no doubt, that water in a liquid ſtate is a compound of ice with a certain quantity of caloric, and that water in gas or vapour, is equally a compound, of which the principles are the ſame, but which contains caloric in a larger proportion. Such is the theory of the formation of elaſtic fluids in general: They are all compounds, conſiſting of a baſe more or leſs ſolid, and matter of heat or caloric. As this laſt principle is ſubject to laws of attraction peculiar to itſelf when it eſcapes from one body, it combines with ſom other:—or rather, bodies with which caloric is combined, when they have a ſtronger attraction for other bodies exhibited to them than for this principle, diſmiſs it, in order to combine with thoſe othe bodies.

There is not a ſingle inſtance in which theſe phenomena of the diſengagement or fixation of caloric, an the diſengagement or fixation of elaſtic fluids are n obſerved, either ſeparately or together. From this ſimp

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heory, which is in reality nothing but a ſtatement of acts, it appears that all elaſtic fluids ought to be diſtinuiſhed by two names; one denoting their aëriform ombination with caloric,—of which ſort are the generic ords, *air*, or *gas*, the firſt to be uſed when thoſe ſubances are proper for maintaining combuſtion and reſiration, the ſecond when they do not contribute to heſe purpoſes; the other, a ſpecific name, denoting he particular baſe of the gas or elaſtic fluid. It will ccordingly be expected, that, in a recapitulation of all he facts of chemiſtry, we ſhould give an account of the aſtic fluids which are either produced and diſengaged, r fixed and abſorbed in the various phenomena benging to this ſcience.

All the elaſtic fluids whoſe properties are worthy of otice, may be arranged in four claſſes.

Class I.

laſtic Fluids capable of maintaining Combuſtion, and the Reſpiration of Animals.

Species 1. Vital air.
2. Atmoſpheric air.

Class II.

laſtic Fluids unfit for maintaining Combuſtion and Reſpiration, and neither ſaline nor ſoluble in Water.

Species 3. Azotic gas.
4. Nitrous gas.

CLASS III.

Elaſtic Fluids unfit for maintaining Combuſtion and Reſpiration, but of a ſaline Nature, and ſoluble i water.

Species 5. Carbonic acid gas.
6. Sulphureous acid gas.
7. Fluoric acid gas.
8. Muriatic acid gas.
9. Oxigenated muriatic acid gas.
10. Ammoniac gas.

CLASS IV.

Elaſtic Fluids neither proper for maintaining Combuſti nor Reſpiration, but inflammable.

Species 11. Hydrogenous gas.
12. Sulphurated hydrogenous gas.
13. Phoſphorated hydrogenous gas.
14. Hydrogenous gas mixed with azote.
15. Hydrogenous gas mixed with carbon acid.
16. Carbonaceous hydrogenous gas.

Of the Nature and leading Properties of theſe differe Species of Elaſtic Fluids.

I. VITAL AIR, called by its diſcoverer, Dr Prieſtle *dephlogiſticated air*, and by ſome other Engli philoſophers, *empyreal air*. and *principium ſorbile*, is preſent extracted from many different matters. *Precipitate per ſe,* or oxide of mercury, *red precipitate* or oxide of mercury prepared by nitric acid, precipitates of the ſeveral mercurial neutral ſalts formed by alkalis, red oxide of lead ſprinkled with a little nitric acid, alkaline and terrene nitrates, nitrate of ſilver, native oxide of manganeſe either by itſelf or ſprinkled with ſulphuric acid, oxigenated muriatic acid, mercurial acetite, arſeniate of zink, all give out either more or leſs of it when expoſed to the action of light and heat. Its diſengagement is evidently effected by the uniform action of theſe two principles. It is not contained ready formed in theſe bodies: they contain only its ſolid baſe, which is melted by caloric and light, and thus reduced into an elaſtic-fluid ſtate; and as it eſcapes, the oxides by degrees aſſume the metallic ſtate. It is alſo obtained from the leaves of plants or trees expoſed in water charged with carbonic acid to the action of the rays of the ſun.

Vital air is often mixed with a little azotic gas; only, that obtained from oxide of mercury, from oxide of manganeſe, from ſuper-oxigenated muriate of potaſh, or from the leaves of plants, is without it.

Vital air is rather heavier than atmoſpheric air; it is the only elaſtic fluid which maintains combuſtion. Pure vital air is four times as powerful for this effect as atmoſpheric air; that is to ſay, a body requiring four cubic feet of atmoſpheric air to effect its combuſtion, may be burnt with one cubic foot of vital air. Combuſtion is accompanied with a good deal of light and heat: theſe two phenomena are occaſioned by the rapid ſeparation of the fire, which forſakes the baſe of this air in proportion as that baſe fixes in the burning body. In ſome inſtances of combuſtion effected by this air, only heat, but no light, is diſengaged. This happens when the diſengagement is accompliſhed ſlowly and by degrees. It contributes alſo in an eminent manner to the reſpiration of animals: and ſupplies their blood with the caloric which raiſes its temperature above the medium in which they live.

The baſe of vital air, by combination with carbone, ſulphur, phoſphorus, azote, arſenic, &c. forms the carbonic, ſulphuric, phoſphoric, nitric, arſenic, &c. acids. It is from its poſſeſſing this property, that we have denominated this baſe oxigene, or the acidifying principle. It is to be obſerved, 1. That theſe combinations do not always take place when thoſe combuſtible bodies are immerſed in vital air; and that different degrees of temperature, above the ordinary temperature of the atmoſphere, are generally requiſite to produce them, at leaſt with ſufficient rapidity. 2. That this baſe or oxigene enters into theſe compounds in different proportions; and that, according as any baſe is more or leſs completely ſaturated, the compound differs in its nature from other compounds not ſaturated preciſely in the ſame degree. 3. That its affinity for theſe different matters is not uniformly the ſame: accordingly, phoſphorus robs the arſenic acid of its oxigene; the phoſphoric acid, again, yields its oxigene to coal, &c. 4. That when it paſſes out of one of thoſe bodies in which it has been fixed in a ſtate very different from that of elaſtic fluidity, into any other body, a ſort of combuſtion actually takes place; which is indeed ſlow, and therefore unaccompa-

nie

ied with either heat or light ; as oxigene, in the ſtate n which it exiſts in ſuch bodies, is combined with but ery little of thoſe principles.

Oxigene combined with hydrogene, forms water ; ith metals, it forms metallic oxides. Coal decompoſes ater and metallic oxides at a high temperature; having hen a greater affinity with oxigene, than either hydroene or metals.

Vital air diſcolours vegetable and animal ſubſtances : hen abſorbed by fixed oils, it thickens them, and reces them into a ſtate reſembling that of wax. With e muriatic and the acetous acids, it forms oxigenated uriatic acid and acetic acid or radical vinegar.

The heat of the ſun, when acting with any conſiderle energy, diſengages oxigene into the ſtate of vital from many of its combinations; ſuch as the oxides of ercury, ſilver, gold, nitric acid, oxigenated muriatic id, &c.

II. *Atmoſpheric* or *common air* is a compound of vital with azotic gas. One hundred parts of atmoſpheric , contain nearly 73 parts of azotic gas and 27 parts of al air. This explains the reaſon why only a fourth rt of any quantity of atmoſpheric air is conſumed before becomes unfit for maintaining combuſtion ; and why e phenomenon of combuſtion takes place more ſlowly, d is accompanied with leſs heat and light in atmoeric, than in pure vital air. But we muſt obſerve, t there is not perhaps a ſingle inſtance of combuſtion, which the 27 parts of vital air contained in the comn air of the atmoſphere, are entirely abſorbed and d in the combuſtible body; and that accordingly the aëriform reſidue of atmoſpheric air remaining after it has contributed to combuſtion, is ſcarce ever pure azotic gas, not even when the burnt body remains in a fixed and ſolid ſtate, without mixing with the elaſtic fluid The gas muſt therefore be ſtill more impure, when the body is burnt under a bell-glaſs filled with atmoſpheric air, and affords a reſidue in a permanent aëriform ſtate as charcoal, and all organic matters containing it, do.

There are a number of bodies which alter atmoſpheri air, by abſorbing the vital air which it contains. Bu we know of none that renew and purify it, except th leaves of vegetables; which, when expoſed to the ray of the ſun, effect a decompoſition of carbonic acid an water, in conſequence of which, they afford a ſupply o vital air to the atmoſphere.

III. *Azotic gas*, which exiſts in the atmoſphere in large proportion, is thus named, becauſe it very ſoo proves fatal to animals, and extinguiſhes combuſtion and accordingly, appears to be in its nature directly op poſite to vital air. Dr Prieſtly called this elaſtic flu *phlogiſticated air ;* imagining that it derived its noxiou properties from phlogiſtion, diſengaged out of burnin bodies, or odorate matters;—in a word, from all tho operations of nature and art, which he has called *ph giſticating proceſſes.*—It has ſince been proved, that th fluid exiſts ready formed in the atmoſphere, and is on ſeparated by the abſorption of vital air. Modern phi ſophers have made more important diſcoveries concer ing this, than concerning any other elaſtic fluid. The are ſeveral ways of obtaining pure azotic gas. Th which is moſt generally in uſe, is the expoſing of a qua ity of liquid ſulphure of potaſh to a given quantity of tmoſpheric air under bell-glaſſes : the vital air is by degrees abſorbed ; and when *it* is entirely abſorbed, the zotic gas remains pure. We owe this proceſs to Scheele. M. Berthollet has diſcovered, that it may alſo be obtain-d, by treating muſcular fleſh, or the fibrous part of the lood, after having waſhed it well, with nitric acid, in an pparatus ſuitable for collecting and preſerving gaſes : ut theſe animal matters, when uſed for this purpoſe, nuſt be perfectly freſh : if altered, they afford, together ith the azotic gas, a mixture of carbonic acid. I my-elf have diſcovered, that the air-bladder of the carp, hich Dr Prieſtly had before obſerved to contain noxi-us air, is full of this fluid, which may be obtained ſim-ly by burſting them under bell-glaſſes filled with water.

Azotic gas is lighter than atmoſpheric air. It inſtant-y extinguiſhes burning tapers ; and acts, with great ra-idity and energy, in deſtroying the life of animals im-erſed into it. When mixed with vital air, in the pro-ortion of 73 to 27, it affords factitious atmoſpheric air : n a larger proportion, it forms an air noxious to animals. Neither water, nor earths, nor acids, are known to act pon this gas : It appears, however, that it is liable to e abſorbed by the nitric acid, which renders it ruddy. Mr Cavendiſh has diſcovered, that three parts of azotic as, mixed in glaſſes with ſeven parts of vital air, and xpoſed to the action of the electric ſpark, are by de-rees condenſed, ſo as to form the nitric acid : Hence the heory of the formation of this acid in the atmoſphere. I. Berthollet has found, that ammoniac is decompoſed y hot nitric acid, by oxigenated muriatic acid, and by he detonation of fulminating gold. He has diſcovered, that ammoniac conſiſts of five parts by weight of azote, and one of hydrogene. He has farther diſcovered, that animal matters contain a great deal of azote, that the ammoniac obtained from them by the action of fire and putrefaction, is formed by the union of that azote with hydrogene,—and that plants, which afford this ſame ſalt by diſtillation, afford it in conſequence of their containing azote, and therefore well deſerve the name of *animal plants*, which has been given them by ſome chemiſts. I have ſince ſatisfied myſelf by experiment, 1. That of all animal matters, the fibrous part affords the moſt azotic gas by nitric acid; 2. That after putrefaction it contains no more azote, but affords then a conſiderable quantity of ammoniac. 3. That ſeveral vegetable matters, in particular the gluten of farina, elaſtic gum, green fecula, and ligneous matter, furniſh azotic gas by the action of the nitric acid.

Theſe remarkable qualities of azotic gas, are particularly worthy the attention of the phyſician. They contribute to explain the difference between animal and vegetable matters, the formation of ammoniac, putrefaction, and the production of the nitric acid from putrid animal matters.

As this elaſtic fluid has been by ſome people confounded with carbonic acid, it is to be remembered that azotic gas has no ſenſible taſte,—is much lighter than that aëriform acid, and neither reddens tincture of turnſole, nor precipitates lime-water.

IV. *Nitrous gas* was in ſome meaſure known to Hales; but Dr Prieſtley is properly the diſcoverer of it. This

laſtic fluid is diſengaged from nitric acid by the action
f a great number of combuſtible bodies, eſpecially
etals, oils, mucilages, and alcohol. It extinguiſhes
ghts; it deſtroy animals; it is neither acid nor alkaline;
is not liable to be altered by pure water. By com-
ination with vital air, it affords nitric acid ; being
ſelf nothing but nitric acid, deprived of a part of its
xigene, and conſequently a compound of azote and ox-
gene,—only, containing more azote and leſs oxigene
an the nitric acid. Hence the varieties of this gas,
ccording as azote and vital air are mixed in it in diffe-
nt proportions; and hence the uncertainty of its ef-
cts as an eudiometer. From this we underſtand, why,
ſeveral inſtances,—eſpecially when, in order to ob-
in nitrous gas, we uſe a body very greedy of oxigene,
d requiring a conſiderable quantity of oxigene to ſa-
rate it,—the nitrous gas obtained, contains naked a-
tic gas; and even, ſometimes, nothing is obtained
ut azotic gas. This nitrous gas, which is formed of a-
te and oxigene, contains a larger proportion of the
igene than atmoſpheric air does. Of this a proof is
tained by decompoſing it by an alkaline ſulphure in
lution. A ſolution of ſulphure of potaſh, when put
to a glaſs filled with nitrous gas, immediately abſorbs
part of the gas: In a ſhort time, the gas is no longer
ddened by the contact of air, and becomes fit for
aintaining combuſtion, even better than atmoſpheric
r. It is actually converted into air, ſomewhat purer
an the air of the atmoſphere, or containing a larger
oportion of vital air than atmoſpheric air uſually con-
ins: But if more nitrous gas be added, and the action
f the ſulphur ſtill continued, the whole of the vital air

is ſoon abſorbed, and what remains is nothing but azotic gas. We may farther obſerve, that nitrous gas communicates to flame a green colour, before extinguiſhing it; and that, in many inſtances this colour is produced by compounds, of which azote forms a part.

Theſe leading properties of nitrous gas, particularly the rapidity of its combination with vital air, ſhew, that it bears an analogy to combuſtible bodies; and it has been obſerved by Macquer, that the artificial formation of nitrous acid by the mixture of theſe two gaſes, is a ſpecies of combuſtion; but as it is not accompanied with flame, I have not ventured to rank nitrous gas among the inflammable gaſes. It differs from atmoſpheric air in the proportion of its principles, and in their ſtate of compreſſion. In nitrous gas, the oxigene and azote are deprived of all that quantity of caloric and light which they poſſeſſed in the atmoſphere. The oxigene, however, ſtill retains enough of both theſe principles to occaſion a combuſtion, with flame, of ſeveral combuſtible bodies, when immerſed in it, as pyrophorus, &c.

V. *Carbonic acid gas* was known before any of the other elaſtic fluids. Dr Black diſcovered its exiſtence in chalk and alkalis; and at the ſame time ſhewed, that it rendered thoſe matters effervеſcent, mild, and ſuſceptible of cryſtallization; and that, when deprived of it alkaline matters become acrid and cauſtic, and are no longer liable to effervеſce, &c. This gas exiſts in the atmoſphere, of which it compoſes nearly one two-hundredth part; in acidulous waters, and in ſome ſubterraneous cavities, ſuch as the *Grotto del Cano*, &c. It

near-

rly twice as heavy as atmoſpheric air; its ſmell is
ngent, and its taſte acrid; it extinguiſhes burning
dies,—kills animals,—reddens tincture of turnſole,—
cipitates lime-water,—renders chalk ſoluble in wa-
,—forms, with all alkaline matters, carbonates, a ſort
cryſtallizable neutral ſalt, in which the properties of
alkali are ſtill diſcernible, on account of the weak-
ſ of the acid. This acid gas, which acts an impor-
t part in the phenomena of nature and art, is a com-
nd of carbone and oxigene; of carbone, in the pro-
tion of twenty-eight hundred parts,—and oxigene,
he proportion of ſeventy-two hundredth parts. As
bone, of all known bodies, appears to have the ſtrong-
affinity for oxigene, the carbonic acid is among thoſe
npounds, of which the decompoſition is the moſt dif-
lt, and one of the products the moſt frequently ob-
ned in chemical analyſes. It is formed in all in-
nces in which bodies containing oxigene are heated
h coal; as in the reduction of metallic oxides by
,—by coal itſelf, &c.—by the decompoſition of orga-
matters containing coal and water, &c.

VI. *Sulphureous acid gas* is obtained, either by the
w combuſtion of ſulphure, or by abſtracting from
phuric acid a part of its oxigene; and is a compound
ſulphure with oxigene, containing the latter principle
a more ſcanty proportion than ſulphuric acid. This
has a ſulphureous ſmell, acrid and pungent, and a
y ſour taſte; it extinguiſhes burning bodies, and kills
mals: Intenſe cold condenſes it into a liquid ſtate:
eddens and diſcolours moſt vegetable blue colours:
ombines with water and with ice, and melts the lat-

ter of theſe ſubſtances by means of the heat which it gives out as it becomes fixed: it abſorbs, by degrees, oxigene from the atmoſphere; and in conſequence of that, paſſes into the ſtate of ſulphuric acid.

VII. *Fluoric acid gas* is diſengaged from native fluate of lime, or *vitreous ſpar*, by ſulphuric acid. Its ſmell and taſte are very ſtrong: it diſſolves ſiliceous earth, and holds it ſuſpended in an aëriform inviſible ſtate. The contact of water, by fixing it, ſeparates a portion of that earth: Alkalis ſeparate it entirely. The nature of this acid gas is unknown; and if it be like moſt other mineral acids, a compound, conſiſting of a ſimple acidifiable baſe with oxigene, its acidifiable radical principle muſt have a very ſtrong affiuity with oxigene; for even coal is not able to decompoſe this gas, by detaching that principle.

VIII. *Muriatic acid gas* is nothing but muriatic acid purified from water, and melted by caloric into an elaſtic fluid. Its ſmell, which is lively and ſuffocating,—its taſte, which is very ſtrong,—its ſolubility in cold water, which readily abſorbs it, and ſeparates the heat by which it was maintained in a ſtate of elaſtic fluidity,—the peculiar neutral ſalts which it forms with terrene and alkaline baſes,—and the white vapour which is obſerved whenever it comes into contact with water diſſolved in the atmoſphere,—are its diſtinguiſhing characteriſtics. Its intimate nature, or component principles, are unknown; its acidifiable baſe has undoubtedly a very ſtrong affinity with oxigene, as theſe principles have never yet been ſeparated. Nay, we are about to ſee, that this acid abſtracts oxigene from various other bodies, when they are ſaturated with it.

IX. *Oxigenated muriatic acid gas* is diſengaged with great facility during the reciprocal action of native oxide of manganeſe and muriatic acid. This peculiar gas s known to be produced by the tranſition of oxigene from the manganeſe into the muriatic acid. This gas lways retains a colouring part, of a greeniſh yellow: Its ſmell is ſtrong and pungent: It is not acid: It weakns and reddens the flame of a taper, but does not exinguiſh it: It is very quickly fatal to animals: It diſolours ſtuffs, tincture of turnſole, and flowers, rendering hem all white: It likewiſe diſcolours and whitens yelow wax, &c.: It decompoſes ammoniac, which may now e uſed as a preſervative againſt its noxious effects: the zotic gas of the ammoniac is ſeparated, while the oxiene of the muriatic gas combines with its hydrogene o form water: It condenſes fixed oils: It oxidates mels; and even mercury and gold are ſubject to its inuence: It is ſoluble in water, and communicates to at fluid all its properties: The contact of light by derees decompoſes it, and reduces it into the ſtate of pure uriatic acid.—The formation of oxigenated muriatic id, and oxigenated muriatic acid gas, is one of the oſt remarkable diſcoveries of modern chemiſtry. This ſcovery ſhews, that the relations of muriatic acid to mbuſtible bodies are directly contrary to thoſe of the her acids. All the other acids appear to be decomſable by moſt of the metals, which have in general a onger affinity with oxigene than the combuſtible ba-of thoſe acids have. The muriatic acid, on the con-

trary, is not decompoſed by any metal: none of the
detaches its oxigene; and in conſequence of this, i
ſcarce acts on any of the metals. Its baſe which is ſtill
unknown, is not only intimately connected with the a-
cidifying principle, but even detaches that principl
from ſeveral other metallic oxides, ſuch as thoſe of mer-
cury, lead, iron, &c. when ſaturated, it is no longer a-
cid; as exceſs of oxigene deſtroys its acidity. The ca
is directly contrary with many other combuſtible bo-
dies. Its exceſs of oxigene enables it to act upon me-
tals, on which, in its ordinary ſtate, it produces n
change; ſuch particularly, are antimony, ſilver, an
gold. While theſe metals rob it of this exceſs of ox
gene, they are by degrees burned, and diſſolved in th
muriatic acid, which returns itſelf into its original ſta
Theſe oxidations and ſolutions of metals, by the oxig
nated muriatic acid are accompliſhed without efferve
cence, in the ſame manner as a ſalt is diſſolved in wate
for the metal takes up the ſuperabundant oxigene
the liquid acid quietly, and with much more eaſe th
if it were obliged to diſengage it from a combuſtib
baſe. Oxigenated muriatic acid likewiſe diſſolves m
tallic oxides, and thereby forms oxigenated muriat
very different in their nature from ſimple muriat
The moſt ſtriking and moſt remarkable of theſe diffe
ences appears in the combinations of the acid, in its d
ferent ſtates with oxide of mercury. With oxigenat
muriatic acid, oxide of mercury forms *corroſive ſublima*
With ſimple muriatic acid, the ſame oxide forms m
mercury. The differences between theſe two ſalts a
therefore owing to the differences between the t
ſtates of the acid in reſpect to the proportions of

oxige

xigene. The ſingular properties of the oxigenated uriatic acid render it extremely uſeful in ſeveral of he arts: ſome of which indeed owe their origin to it, s the bleaching of linen and cotton diſcovered by M. erthollet.

X. *Ammoniac gas*, diſcovered by Dr Prieſtley, is diſngaged by heat from liquid ammoniac, and, with ſtill ore rapidity, from a mixture of ammoniacal muriate, r common ſal ammoniac, with quick-lime. This elaſc fluid, when collected in glaſſes over mercury, is found be a little heavier than atmoſpheric air. The degree cold or preſſure at which it loſes its aëriform fluidity, ſtill undetermined. It combines with water, giving t, while the combination takes place, a good deal of at: it melts ice: it renders ſyrup of violets, as well blue and red flowers, green: it combines rapidly with rbonic, ſulphureous, and muriatic acid gaſes; theſe mbinations produce a good deal of heat: as this heat diſengaged from the two elaſtic fluids, theſe become lid while the combinations are forming.

Ammoniac gas is ſpeedily decompoſed by the contact oxigenated muriatic acid gas: the decompoſition is companied by heat: a quantity of water, charged th muriatic acid, is formed, and there is a reſidue of otic gas. This experiment, as well as ſeveral others hich have been already mentioned, proves ammoniac conſiſt of hydrogene and azote. The decompoſition ammoniacal copper, and of *fulminating gold* and *ſilver*, hich afford, by the action of fire, water, reduced mel, and azotic gas, is another proof that ammoniac gas nſiſts of theſe principles; for, the hydrogene of this alkali having a ſtronger affinity for oxigene than either gold or ſilver, detaches it from the oxides of theſe metals, and, leaving its azote to be diſengaged into a gazeous ſtate, forms water with the oxigene which it has acquired in this manner. The phenomena of this decompoſition of ammoniac by oxides are very much diverſified—from that which oxide of copper effects ſlowly, and with the aſſiſtance of a ſtrong heat,—to the amazing rapidity with which ammoniacal oxide of ſilve is reduced, when it detonates by the momentary co tact of heat. The diverſity of theſe phenomena is ow ing to the various affinities of oxigene with the differen metals.

Oxides of zinc and iron, which, in their metalli ſtate, decompoſe water, have not the ſame power ove ammoniac ; for theſe metals have a greater affinity wit oxigene, than oxigene has with hydrogene. Hence i is eaſy to conceive, 1. how ammoniac is produced b the putrifaction of animal ſubſtances, and during the d compoſition of water and nitric acid by ſome metals, tin. 2. How, in oppoſite circumſtances, when ammon ac is decompoſed by metallic oxides, the nitric ac comes to be formed.

XI. *Pure hydrogenous gas*, univerſally known by t name of *inflammable air*, is the lighteſt of all aërifo fluids : When very pure, it is thirteen or fourteen tim lighter than atmoſpheric air. It extinguiſhes burni bodies : it kills animals : it is kindled by the contact the electric ſpark, or of any flaming combuſtible bod it burns with a bright flame. Fifteen parts of this abſorb, in burning, eighty-five of vital air ; and by t

combuſti

ombuſtion, an hundred parts of very pure water are
rmed—if the elaſtic fluids be pure. The water is
herefore a compound of theſe two bodies, deprived of
oſt of the heat which is neceſſary to maintain them
the ſtate of elaſtic fluidity. All ſubſtances having a
ronger affinity with any one of theſe two principles,
an that by which their union is maintained, decompoſe
is fluid. Thus, iron, zinc, coal, and oil, decom-
oſe water, and ſeparate hydrogene from it into a ga-
ous ſtate ; as they have a ſtronger affinity with the
aſe of vital air or oxigene than it has with hydrogene.
rom this it is clear, that hydrogenous gas cannot be
pected to decompoſe carbonic acid, or the oxides of
nc and iron : On the contrary, ſulphur, and ſuch me-
ls as do not decompoſe water, give up the oxigene
hich they contain, in the ſtate of ſulphuric acid, and
metallic oxides, to hydrogenous gas : which reduces
e former into the ſtate of pure ſulphur, and the lat-
r into the ſtate of metals. This decompoſition of wa-
r by iron and zinc, is the cauſe from which proceeds
e hydrogenous gas produced during the ſolution of
eſe two metals by the ſulphuric, the muriatic, the
rbonic, or the acetous acid.

The leaves of vegetables, on the contrary, appear to
ſſeſs the property of abſorbing the hydrogene of wa-
, and diſengaging its oxigene into the ſtate of pure
. Light contributes greatly to this decompoſition ;
d without the contact of light it is never effected.
appears to ſerve for the purpoſe of melting oxigene,
d thus forming it into vital air ; and, while the oxi-
ne is diſengaged, the hydrogene becomes fixed in
vegetable, and ſerves, no doubt, for the produc-

tion of oil. We begin to perceive that hydrogene combines with carbone and a ſmall proportion of oxigene to form the oil of vegetables; and that theſe again decompoſe carbonic acid together with water, to abſorb the carbone of the firſt, and the hydrogene of the laſt of theſe compounds. Hydrogene, or the baſe of hydrogenous gas, forms ammoniac, by combination with azote, or the baſe of azotic gas. M. Berthollet, by analyſing that ſalt, has ſhewn this to be its compoſition: But we have not yet been able to form ammoniac by the immediate combination of theſe two principles.

We have never yet been able to ſeparate the matte of heat combined in hydrogenous gas, to which tha gas owes its elaſtic fluidity, without fixing the hydrogene in ſome other compound; and therefore, we ar ſtill unacquainted with hydrogene in a ſolitary inſulate ſtate. The degree of preſſure or cold neceſſary to effe this ſeparation, muſt be ſuch as we have not yet learne to apply: Every thing, indeed, concurs to ſhew, tha either the one or the other muſt be in an extreme degre

The ſudden diſengagement, and the rapid inflammation of hydrogenous gas, produce all the fulminatio and detonations which are obſerved in chemiſtry. Th inſtantaneous recompoſition of water is almoſt invariably the conſequence of theſe detonations.

Hydrogenous gas performs an important part in th phenomena of nature. A great quantity of it is produced and diſengaged in mines: It there reduce and colours various metallic oxides: it riſes in the atmoſphere, is carried about by the winds, and kindled by the electric ſpark: accordingly, it acts th part of thunder; and immediately upon its detonatio quantity of water is formed, which ſtreams down upn the earth.

The inflammation of this gas by the electric ſpark, is ne of the moſt remarkable phenomena in nature, and ne of thoſe of which the origin is leaſt known. We re equally at a loſs to explain, how the electric ſpark omes to be capable of fixing a mixture of vital air and zotic gas into nitric acid.

XII. Sulphurated hydrogenous gas, or *hepatic gas*, as been very well diſtinguiſhed from other hepatic gaes by Bergman. It is obtained from ſolid alkaline ſulhures, or *livers of ſulphur*, by decompoſing them with cids in a pneumato-chemical apparatus. This aërirm fluid has a very fetid ſmell; it kills animals: it enders ſyrup of violets green: vital air precipitates lphur from it; it is kindled by the electric ſpark, and y the contact of burning bodies: it burns with a rediſh blue flame; and, as it burns, depoſites ſulphur on he ſides of the veſſels containing it: the ruddy nitrous cid, the ſulphureous acid, and the oxigenated muriac acid decompoſe it, deſtroy its elaſtic fluidity, and parate the ſulphur. It combines with water, and the lution is decompoſed by the action of air: ſulphuraed hydrogenous gas colours and reduces oxides of lead, iſmuth, &c.; it precipitates ſolutions of metals. Some etals, particularly mercury and ſilver, ſeparate he ſulphur; accordingly, when paſſed through glaſſes ontaining mercury, a great part of it is decompoſed.

All theſe phenomena agree in ſhewing, that this gas ontains ſulphur in a very attenuated ſtate. M. Genembre, by an analyſis, has diſcovered it to conſiſt of hydrogenous gas and ſulphur: to the ſolution or ſuſpen ſion of ſulphur, it owes its diſtinguiſhing characteriſtic. The ſulphur, however much attenuated, does not bur at the ſame time with the hydrogenous gas, but is i part depoſited during the combuſtion of the gas: Th cauſe of this phenomenon is, that hydrogenous gas doe not need combuſtion of ſo high a temperature as ſulphu

It is ſulphurated hydrogenous gas which mineraliſe ſulphureous waters. On this account, the common aci never precipitate ſulphur from thoſe waters; but th nitrous acid, the ſulphureous acid, and the oxigenate muriatic acid, in which the oxigene is not very intimate ly combined with the acidifiable baſe, ſeparate the ſul phur by abſorbing the hydrogene. If too much of an of theſe acids be employed, eſpecially of the oxigenate muriatic acid, the ſulphur of this gas will be burne and converted into ſulphuric acid; and then no prec pitate will appear.

Our acquaintance with ſulphurated hydrogenous g enables us to explain ſeveral things concerning ſulphu which we were before unable to account for. 1. W know now, why ſolid ſulphures, recently prepared, a without ſmell; and what occaſions their becoming ſtrongly fetid, when moiſtened: 2. It appears th water, though not decompoſable by ſulphur alone, eaſily decompoſed by the joint action of ſulphur and a kaline matters: 3. We underſtand fully, how alkali ſulphures come to be decompoſed by the air, and by ſ veral metallic oxides, eſpecially by the oxides of meta which do not decompoſe water: 4. The theory of ſu phureous mineral waters is now eaſy to explain; as we as the hiſtory of their decompoſition by air and metall oxides; and the difficulties which were formerly foun n all attempts to detect the ſulphur by ſimple acids, hile it was not ſuſpected to exiſt in thoſe waters in any ther ſtate but ſulphure or *hepar*.

XIII. *Phoſphorated hydrogenous gas* was diſcovered by I. Gengembre, who called it at the firſt, *phoſphoric gas*. e obtained it, by boiling a lixivium of cauſtic potaſh ith half its weight of phoſphorus, and receiving the laſtic fluid that was diſengaged, into glaſſes containing ercury. It kindles by the mere contact of air, pro-ucing as it takes fire, a faint exploſion. The ſolid hoſphoric acid which it affords, forms, when burning, ſort of *corona* in the air, when not agitated; and to-ards its extremity, the diameter of the flame does not iminiſh, but is enlarged. When mixed with vital air nder glaſſes, it burns with the greateſt rapidity, and roduces ſuch heat and dilatation that the glaſſes burſt they be not very thick, or if the proportions of the ixture be too large. M, Gengembre has ſhown, that is new gas is a ſolution of phoſphorus and hydrogenous as. It bears a conſiderable reſemblance to ſulphurated ydrogenous gas; and differs from it in nothing but the ature of the combuſtible body ſuſpended in the hydro-enous gas. As phoſphorus is much more combuſtible an ſulphur, phoſphoric hydrogenous gas kindles in the r: the phoſphorus is firſt kindled, and communicates e inflammation to the hydrogenous gas, which is heated y its combuſtion. In ſulphurated hydrogenous gas, on e contrary, the hydrogenous gas is kindled only by the ntact of ſome burning body; and the ſulphur not eing ſufficiently heated, is ſeparated unburnt.

XIV. *Hydrogenous gas*, mixed with azotic gas, forms that elaſtic fluid which M. Volta has denominated *inflammable air of marſhes.* It is produced by the putrefaction of ſome vegetable matters, and of all animal ſubſtances. It is diſengaged from waters in marſhes, ponds houſes of office, and all places where there are animal matters putrefying in water. It either accompanies, precedes, or follows the formation of ammoniac which take place in putrefaction. I take it to be a ſimple mixtur of which the component parts are not united by combination; for, were they actually combined, the reſul would be ammoniac: but it differs from ammoniac, 1 In the elaſtic ſtate of the two fluids of which it conſiſts 2. In the proportions of thoſe elaſtic fluids, which var in this mixed acid, but in ammoniac are always the ſame We are indebted for our preſent accurate knowledge o this gas to M. Berthollet. In the years 1778 an 1779, I examined the inflammable gas of marſhes, an diſcovered it to contain carbonic acid: but in ſeveral o thoſe gaſes, found in different parts of the neighbourhood of Paris, I found a mixture, the nature of which did not properly diſtinguiſh; although I aſſerted, as ma may be ſeen in the 164th page of the collection of m Memoirs in 8vo, that it is ſometimes accompanied, o even has its place ſupplied by *phlogiſticated gas*, whic as I have elſewhere ſhewn, is the ſame with what we a preſent call azotic gas. Theſe were merely vague aſſertions at the time when I inſerted them in my Memoirs: but M. Berthollet has ſince communicated them a degree of certainty and preciſion which induc me to diſtinguiſh this gas by the peculiar names abo given to it.

Hydrogenous gas, mixed with azotic gas, burns wi a blue flame. It detonizes, but not eaſily, with vital a

hen cauſed to detonize, in M. Volta's eudiometer, it
found to produce ſome drops of water, and a reſidue
ore or leſs pure.

XV. I diſtinguiſh, by the title of *hydrogenous gas*
ixed with carbonic acid, that gas which is obtained by
ſtillation from many vegetable matters, particularly
om tartar, and all tartareous ſalts; from acetous ſalts;
om hard wood; from charcoal burning with the help
water; from mineral coal, &c.

It does not burn very readily; but it is not abſolutely
combuſtible, even though three fourths of its bulk be
rbonic acid. This acid is ſeparated from it, and the
drogenous gas purified by lime-water and cauſtic al-
lis. It is a ſimple mixture, without combination. Hy-
ogenous gas is not capable of decompoſing carbonic
id; for coal decompoſes water, having a ſtronger affi-
ty than hydrogene for its oxigene.

XVI. *Laſtly*, It is now known that coal, though very
uch fixed in cloſe veſſels, and in our common fires, is
ble to be redued to vapour, and diſſolved into elaſtic
uids, in a very high temperature. Hydrogenous gas
ts with more energy then any other ſubſtance in diſ-
lving carbone, and maintaining it in ſuſpenſion; it fre-
uently therefore carries it with it, as it aſſumes an elaſ-
c fluid form. It is this mixed gas that is diſengaged,
hen caſt iron and ſteel are diſſolved in ſulphureous a-
d diluted in water. In conſequence of the former ha-
ng abſorbed carbonaceous matter in the tops of the fur-
ces, and the latter in its cementation, it even appears
at coal may be directly diſſolved in hydrogenous gas,

by directing the rays of the ſun from the focus of a mirror, through the middle of a glaſs filled with this gas, upon coal placed on mercury in the bottom of the glaſs. This fluid burns with a blue flame; and gives out during its combuſtion, ſmall white or reddiſh ſparks. The exiſtence of coal in ſolution in this gas, appears from its gravity, and from its combuſtion in vital air, which produces carbonic acid. It likewiſe appears, that coal communicates to hydrogenous gas its well-known fetid ſmell, or at leaſt it renders that ſmell ſtronger. Laſtly, coal modifies the effects of this gas, and changes the reſults of its combinations. Thus, a mixed gas, formed by the ſolution of coal in azotic gas, ſeems to be the colouring matter of Pruſſian blue. But we are not yet acquainted with all the compounds into which coal enters: and the ſame is to be ſaid of the various mixtures of all the gaſes with one another, which certainly take place in a great many inſtances, but of which chemiſtry has not yet eſtimated the effects.

Of the Application of the Facts which have been collected concerning the Nature and Properties of Elaſtic Fluids to the great Chemical Phenomena produced by Nature and Art.

It is now acknowledged as an unqueſtionable fact that there is perhaps not a ſingle phenomenon in chemiſtry in which ſome elaſtic fluid is not either diſengaged or fixed; nay, ſometimes both the diſengagement and fixation of elaſtic fluids take place on the ſame occaſion; and the diſcoveries of the moderns have proved, that the manner in which ſuch phenomena were formerly ac-

counte

ounted for, neither explained the cauſes, nor gave a ſt view of the effects. The perſpicuity which theſe ſcoveries have introduced into this part of the ſcience, a ſufficient proof of their importance.

On comparing the numerous facts which conſtitute the eſent ſyſtem of chemical knowledge, it appears that ey may be reduced to a few general claſſes, contain- g them all under diſtinct heads. Such an arrange- ent is the more neceſſary, as it ſhows the connections nd mutual relations of thoſe facts ; and muſt form, of onſequence, the elements of the ſcience of chemiſtry. ut this laſt object cannot be attained, till all the gene- l phenomena be explained : and as we are ſtill unable account for a number of theſe, as I am about to ſhow, is method of laying down the elements of chemiſtry to be conſidered in no other light than as a propoſal, e importance and utility of which render it worthy the tention of philoſophers.

It is with a view to contribute in part to the carrying f this project into execution, or at leaſt to ſhow that it not impoſſible, that I have attempted to reduce all e facts, and the whole theory of chemiſtry, under urteen leading phenomena, comprehending the vari- us changes which natural bodies are liable to ſuffer om the action of the chemical affinities. In order to roceed regularly from ſimple to compound, in explain- g theſe phenomena, I arrange them in the following rder :

1. The abſorption or diſengagement of caloric, and e production or diminution of heat, with the effects f both.

2. The influence of air on combuſtion, and the general nature of combuſtible bodies.

3. The effects produced by light on bodies.

4. The decompoſition and the recompoſition of water.

5. The production and the decompoſition of earths,

6. The formation and the decompoſition of alkalis,

7. Acidification; the formation and decompoſition o acids; the nature of theſe ſalts, their differences, thei analogies, their action on moſt bodies, &c.

8. The combinations of acids with earths and alkali

9. The oxidation and the reduction of metals.

10. The ſolution of metals by acids.

11. The formation of the immediate principles o vegetables by vegetation.

12. The ſeveral ſorts of fermentation.

13. The formation of animal matters by the life o animals.

14. The decompoſition and putrefaction of anim matters.

Let us briefly conſider each of theſe phenomena, an explain their eſſential relation to the properties of ela tic fluids.

I. *The production of heat* or diſengagement of calori is owing either to the force of preſſure, which diſengages it from bodies in which it is contained,—or to combination, which diſengages it in like manner. It is t be obſerved, that this phenomenon takes place mo eſpecially when an elaſtic fluid is fixed in any body because, as we have already ſeen, the aëriform ſtate o any ſubſtance ſuppoſes the preſence of a good deal o

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ombined heat. It is alſo to be obſerved, that as every
ifferent body contains a different quantity of heat, or,
other words, different bodies have different capaci-
es of heat,—therefore preſſure or combination muſt
oduce, from different bodies, very different quanti-
es of this ſubſtance. For which reaſon, this pheno-
enon, which accompanies a great part of the opera-
ons of chemiſtry, ſhould be obſerved and eſtimated
ith the utmoſt care, in experiments in which accuracy
intended. Similar to this, is the manner in which
e apparent deſtruction of heat or *abſorption of caloric*
kes place, which is likewiſe very often obſerved in
emical proceſſes. It always depends on the increaſe
the bulk of bodies, and on their then acquiring a
eater capacity for the reception of caloric. Both of
eſe phenomena, therefore, may be eſtimated mecha-
cally, or merely by obſerving how the particles of
dies are compreſſed together, or removed from each
her. But in order to form a more juſt idea of it, we
uſt add to this mechanical cauſe, the conſideration of
e particular chemical attraction or affinity between
at and the body on which we are obſerving its ope-
tion. The moderns have made a great many diſcove-
s reſpecting the influence of caloric in combinations
d decompoſitions.

II. Combuſtion is one of the moſt important pheno-
ena in nature. We may diſtinguiſh two diſtinct claſ-
of combuſtions,—thoſe which take place in the air,
d thoſe which take place apparently without the
ntact of vital air, but on ſubſtances containing its
ſe.

Combuſtions effected by the contact of air, are, as h been already ſaid, combinations of the combuſtible bod with the baſe of vital air or oxigene. In proportion a theſe combinations take place, the matter of light an caloric are ſeparated from the oxigene, and appear i the form of ſenſible heat and light. There are fo combuſtible bodies which diſengage theſe fluids flowl from vital air, and afford only little heat when the burn: others, again, diſengage theſe principles rapi ly, and cauſe them to appear in the form of ſparkli light, and glowing heat. By communicating more o leſs oſcillation to this light, they give it different ſhade of colouring; if, with Euler, we conſider different co loured rays of light as being all the ſame matter, onl actuated by different oſcillations, ſimilar to the vibr tions of ſound. In certain combuſtions effected by ai the combuſtible bodies have ſo great an affinity to th baſe of the elaſtic fluid, that they attract it with th utmoſt facility; others require, in order to their com bination with oxigene, a temperature ſometimes ex ceedingly high, which appears to promote the attracti influence of the combuſtible body on that baſe. Th theory accounts for the increaſe of the weight of burnt body; the change of its ſtate; the impurity atmoſpheric air after combuſtion,—for the proporti of azotic gas then becomes much larger,—and the d verſity of the phenomena, ſuch as flame, heat, and r refaction, which accompany every ſpecies of combu tion which is effected in the atmoſphere.

The ſecond claſs of combuſtions is generally effecte in cloſe veſſels. It conſiſts in general in the tranſitio of oxigene, either more or leſs ſolid, out of a body a

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eady burnt, into an unburnt body. It depends upon
he different elective attractions of this principle, for dif-
rent combuſtible baſes. To this claſs belong, the oxi-
ation of metals by acids,—the reduction of metallic ox-
les by coal,—the combuſtion of ſulphur, phoſphorus,
al, and carbure of iron by nitric acid,—the combuſ-
on of hydrogene, the principle of ammoniac, by the
igenated muriatic acid, &c. &c. In all theſe inſtances,
igene paſſes out of one body into another; and as it
as not melted by heat and light, theſe combuſtions ge-
rally take place without flame. We may obſerve,
at in theſe inſtances of combuſtion, which may be
lled *tacit*, the property of combuſtibility is not loſt,
t only transferred from the body which abſorbs the
igene to that which loſes it. We may likewiſe add,
at as oxigene is more or leſs ſolid, that is, more or leſs
ſtitute of heat and light, in the compounds into which
nters, bodies which detach it may ſometimes abſorb
n a ſtate more pure and ſolid than that in which it was
ntained in thoſe in which it before exiſted: and the
engagement of heat, and even of light, muſt then
e place. Such is the origin of theſe two phenomena
detonations by nitre,—in the apparent action of nitric
d on ſulphur, coal, phoſphorus, the generality of
tals, oils, and alcohol.

II. *The effects of light on bodies*, have not been hi-
rto eſtimated any other way than by their conſe-
nces; their cauſe has never yet been properly ex-
ined. It has been long known to act upon vegeta-
, to communicate to them colour, and to develope
ir combuſtible principles. Scheele obſerved, that

the rays of the ſun coloured nitric acid, muriate of ſilver, mercurial precipitates, &c. It is at preſent well known, that all theſe effects are attended with the diſengagement of a more or leſs conſiderable quantity of vital air: light, therefore, acts at the ſame time with heat upon theſe bodies,—ſeparates their oxigene, melts it, and cauſes it to paſs into the ſtate of elaſtic fluidity. It is in this manner that it contributes to the decompoſition of carbonic acid by the leaves of vegetables. That decompoſition is, in truth, owing to a double attraction; 1. The attraction of light and heat for oxigene, which they tend to diſengage into vital air, &c. 2. That with which vegetable matters act upon carbone, the radical principle of this acid. By the ſam mechaniſm, light promotes the decompoſition of wat by the ſame organs of vegetables, and contributes t the formation of their oleaginous principle. By attending with more care than has been hitherto done, t the action of light upon many natural bodies, ſome important diſcoveries may be made, as I pointed out the year 1780.

IV. *The formation and the decompoſition of wat* depend entirely on the affinities of oxigene, which is o of its principles. Zinc, iron, oils, and coal, are alre known to poſſeſs the property of ſeparating the pri ples of water, by abſorbing its oxigene, and diſeng ing its other principle, hydrogene, in the form of drogenous or inflammable gas. The extreme levity this gas, accounts for the high temperature requiſite effect this decompoſition ſuddenly. It appears, that baſe of this gas, hydrogene, which is commonly ei

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quid or ſolid, in the two ſtates in which water is com- only found on the ſurface of the globe, has a very eat capacity for containing the matter of heat. It en appears, that this baſe, though combined with igene and water, ſtill poſſeſſes this property of ab- bing a great deal of heat; and that it is this proper- which renders aqueous vapour lighter than air; in nſequence of which, the mercury ſinks in the baro- eter, when the atmoſphere is filled with that vapour. his noble diſcovery of the nature and the decompoſi- n of water, throws much light on the theories of me- lic ſolutions,—of the oxidation of various metals by iſture,—of the formation of the immediate principles vegetables,—of ſpirituous fermentation, and of putre- tion: And we already ſee, that almoſt all chemical ories are referable to, and depend upon the affinities oxigene. It throws alſo great light on the phenome- of the atmoſphere,—the formation of meteors,—the s which nature obſerves in the ſucceſſive changes of anic matters, &c. It is particularly worthy of ob- ation, that ſuch ſubſtances as do not ſingly decom- e water, effect this decompoſition by the aſſiſtance of er bodies. Thus ſulphur with alkali, tin with nitric d, &c. decompoſe water at low temperatures, by ans of complex affinities. Nothing can contribute e to throw light on a great number of the phenome- of nature and the arts, than the knowledge of theſe diſpoſing affinities, &c.

V. There are ſtill ſeveral important *deſiderata* with ect to the formation of bodies, which the labours of miſts have not explained. One of theſe is the *for-*

mation of earths. Naturaliſts have given their opinions concerning the formation of earths: ſeveral of them have conſidered the converſion of ſilex into clay, as a fact ſufficiently proved; but that notion is nothing but an ingenious hypotheſis, not ſupported by facts. Chemiſts have not been able to change either ſiliceous earth into alumine, or alumine into ſiliceous earth. Nature, perhaps, operates this converſion; but as we are unacquainted with the means which ſhe employs, we ſhould not venture to gueſs, when not countenanced by direct experiments. To conſider barytes, magneſia, and lime as compounds conſiſting of ſiliceous and aluminous earths united with ſome other bodies, is to advance hypotheſes which deſerve but very little credit. No chemiſt has hitherto directed his enquiries to this ſcope; the neceſſary *data* are even wanting. The experiments of ſome moderns on the extraction of pretended metallic reguli, from earths treated with charcoal in a violent heat, have afforded only a fallacious reſult. It appears to be aſcertained that all theſe reguli are but one and the ſame ſubſtance, phoſphure of iron, formed from the earth of bones.

VI. Nearly ſimilar is the ſtate of our knowledge with reſpect to the formation of fixed alkalis. The modern ideas of the principles of chemiſtry, lead us to ſuſpect azote as a principle of theſe ſalts.—We may perhaps even venture to conſider this body, the exiſtence of which in ammoniac has been fully proved by M. Berthollet, as a principle common to fixed alkalis and alkaline earths in general,—in a word, as the *alkaligenous* principle. For inſtance, there can be no doubt, that the fixed alis are partly decompoſed in many of the operations f Chemiſtry : in the diſtillation of old ſoaps, and tar-areous and acetous neutral ſalts, they are plainly hanged into ammoniac.—This tranſmutation ſeems to hew, that fixed alkalis contain azote, which, by at-aching itſelf to the hydrogene of the oil, forms ammo-iac.—But theſe facts have not yet been carefully ex-mined, with reſpect to the quantities of the fixed al-alis which appear to be decompoſed, and that of the mmoniac which is obtained,—nor, what is of no leſs mportance, with reſpect to the reſidue produced from e fixed alkalis ; and we cannot hope to eſtabliſh our heory upon this fact, till its circumſtances be more actly known. But though theſe were known, we ould ſtill have to enquire into the nature of the other rinciple or principles of fixed alkalis, and in what anner the radical principle of potaſh differs from that f ſoda, &c.

VII. *The formation and the decompoſition of acids*, is e of the moſt valuable and beſt known parts of mo-ern chemiſtry. We know that they conſiſt all of a baſe r radical principle, more or leſs combuſtible, in combi-ation with oxigene : that the oxigene being the ſame them all, is the principle of their acidity ; and that e differences among them are owing to the ſubſtan-s combined with the oxigene ; which differ in each ifferent acid.—We know the baſes of the ſulphuric, e nitric, the carbonic, the arſenic, and the phoſpho-c acids : we know them to be ſulphur, azote, coal, ſenic, and phoſphorus. But the acidifiable baſes of e muriatic, the fluoric, and the boracic acids in the mineral kingdom, remain ſtill undiſcovered ; as well as the proportions in which hydrogene and carbone, which ſeem to form the baſes of all the vegetable acids, are united in them.

The decompoſition of the acids whoſe nature is known, is not hard to explain. We know that it muſt happen, whenever a combuſtible body, having a ſtronger affinity with oxigene than oxigene has with the acidifiable baſe, is applied to any acid : And ſuch is the theory of ſulphureous and nitrous acid gaſes by the decompoſition of the ſulphuric and nitric acids, &c.

The radicals of acids ought alſo to be diſtinguiſhed into ſimple and compound ; ſulphur, phoſphorus, carbone, &c. are ſimple radicals. All the vegetable acids have radicals, that are formed of hydrogene and carbone. Theſe laſt are not decompoſed by combuſtible bodies, becauſe their radicals have more affinity with oxigene than metallic matters, &c. which are generally employed in this decompoſition. Thus, of metallic ſubſtances, only the metallic acids are ſoluble in the vegetable acids.

VIII. *The combination of acids with earths and alkalis*, forms the hiſtory of neutral ſalts, and of the mutual affinities or elective attractions of thoſe different matters. It comprehends the examination of the phenomena which take place when they unite,—the taſte which they acquire,—their form, ſolution, cryſtalliſation, alterations by fire and air, and mutual decompoſitions. It has been treated of at great length in this work.

IX. The oxidation and reduction of metals is alſo re-
able to the hiſtory of air and oxigene. We know,
t what has been called the *calcination* of metals, is
ombuſtion,—that it conſiſts in the union and fixation
the baſe of vital air or oxigene, in the metal calcined;
hat metallic *calces* are compounds of metals and oxi-
ne, which we call *oxides* ;—that moſt oxides are re-
ced only by giving out their oxigene to ſome other
dy having a ſtronger affinity with it ;—that coal, by
orbing oxigene from metallic oxides in this manner,
ms with it the carbonic acid, which is diſengaged in
h abundance during their reduction ;—and that there
ſome metallic oxides, from which oxigene is ſepa-
ed in the ſtate of vital air, by means of heat and
ht,—a fact which proves, that this oxigene is com-
ed with different metals, with very different degrees
adheſive force. Thus ſeveral metals heated with me-
lic oxide, carry off their oxigene, as iron and zinc from
oxide of mercury, tin from the oxide of copper, &c.
t two very important particulars in the hiſtory of the
dation of metals, which have been aſcertained by mo-
n experiments, and which throw great light on all
phenomena of metallic matters, are, 1. That every
erent metal abſorbs, in order to its ſaturation, a dif-
ent quantity of oxigene: 2. That each metal may
ſt in different ſtates of oxidation,—or, combined with
erent proportions of oxigene,—from that which mere-
begins the oxidation of a metal, to that by which it
ompletely accompliſhed,—for inſtance, from fifteen
forty or more parts of oxigene, to the hundred
ight of iron.

The attentive examination of this ſecond fact, leads us to diſtinguiſh, in every metallic oxide, ſeveral diffe ent ſtates in reſpect to the quantity of oxigene which i contains. Thus, mercury ſuffers an incipient oxidatio and is changed into a black powder in a number of ci cumſtances, which have been hitherto conſidered as e fecting only an extreme attenuation of the metal : an particularly when triturated or extinguiſhed with fat mucilages, ſyrups, &c. Thus, iron, in the ſtate of ma tial ethiops, is the firſt oxide of that metal, in reſpe of the ſmall quantity of oxigene which it contains, an cold water eaſily reduces the metal into this ſtate Laſtly, copper, beginning to be oxidated, or combine with the ſmalleſt poſſible quantity of oxigene, is brow and reddiſh ; whereas an oxide of this metal, fully ſ turated with oxigene, is of a bright green.

This diſtinction of metallic oxides, according to the different ſtates of oxidation, or according as they conta different quantities of oxigene, and poſſeſs different p perties, in conſequence of their having been more or le burnt, enables us to explain a great many phenomen of which chemiſts were formerly able to give no ſati factory account.

X. *The ſolution of metals* in different acids, the p perties of theſe ſolutions, and of the ſalts which th afford, agree very well with the modern theory, and a much better explained by it, than they formerly we No ſolution of a metal in an acid can take place, wi out the metal's being firſt oxidated.

Metals are oxidated by the ſulphuric acid,—either the acid itſelf, or by the water in which it is dilut

n the firſt of theſe caſes, the acid is decompoſed, and a
uantity of ſulphureous acid gas diſengaged ; in the ſe-
ond, the water is decompoſed, and hydrogenous gas diſ-
ngaged. Some metals decompoſe only the ſulphuric
cid, without acting upon the water ; ſuch as mercury,
ad, &c. ; and to burn theſe metals, the acid muſt be
oncentrated. Metals which act with more energy in
ecompoſing water than in decompoſing ſulphuric acid,
ch as zinc and iron, are not ſo readily oxidated unleſs
e acid be diluted, as it is from the water they muſt de-
re the neceſſary oxigene. What proves the certainty
this laſt fact is, that the ſulphuric acid remains undi-
iniſhed, none of it being decompoſed. From theſe
rcumſtances it is clear, that much more ſulphuric acid
uſt be neceſſary for the ſolution of a metal which de-
mpoſes the acid, than for the ſolution of a metal
hich decompoſes the water combined with it. In the
rmer caſe, two different ſums of the acid are requiſite,
e to oxidate the metal, and another to diſſolve the
etallic oxide : if only the firſt ſum were mixed with
e metal, it would only be oxidated, and the ſecond
m of acid would ſtill be neceſſary to diſſolve the oxide :
the laboratories, there is frequently occaſion to make
ch an addition. Accurate obſervation has ſhown, that
etallic oxides ought to be always in the ſame degree of
idation or combination with oxigene, in order that
ey may be diſſolved in the ſulphuric acid ; and that
en they are fully ſaturated with the acid, they no
nger combine with it. Before this period, they are
t ſoluble in it ; beyond it they are precipitated,—an
ent which happens when a ſulphuric ſolution is expo-
d to too ſtrong a heat, or left for a longer or ſhorter

time expoſed to the air. In the firſt of theſe operation the heat promotes the action of the metallic oxide upon the acid; and it of conſequence takes up more oxigene than it contained or needed in order to remain ſuſpend- ed in the acid; in the ſecond inſtance, it abſorbs tha principle from the atmoſphere, till acquiring more tha is neceſſary to its ſuſpenſion, the oxide is precipitat Such is the theory of ſulphuric mother-waters. Slu tions of metals by this acid afford cryſtals only in th former caſe. All theſe facts agree in ſhewing, that th metals act firſt upon their ſolvents; and that the ſulph ric acid does not act upon them till they be oxidated t a certain degree.

Nitric acid is likewiſe decompoſed by moſt met They are oxidated or *calcined* to a certain degree by th ſorbing its oxigene, with which they have a greater af nity than azote. But as they do not take up all the ox gene of the nitric acid,—not, at leaſt, unleſs too much the metal be employed, and the mixture be too muc heated,—the azote is ſeparated in combination with portion of oxigene; and this particular combination co ſtitutes nitrous gas. The nitric acid is more liable to d compoſition than any other acid; its two component pri ciples not being very intimately united. For this reaſo it has always been conſidered as the chief ſolvent; a it is owing to the ſame circumſtance, that water is ſ dom decompoſed during the mutual action of metals a the nitric acid, and that a large quantity of water put ſtop to this re-action. Accordingly, ſolutions of met in the nitric acid afford only one ſort of elaſtic fluid, trous gas, which is ſometimes mixed with a little gas zote, eſpecially if the metals employed havea very ſtro nity with oxigene, and abſorb a great deal of it. Metals which are ſoluble in the nitric acid combine, l remain in combination with it, only when contain- a certain quantity of oxigene not equal to their ſa- ation. Many metallic oxides, therefore, ſuch as thoſe biſmuth, antimony, mercury, tin, and iron, are very ly ſeparated from nitric acid, ſolely by reſt, by heat, by expoſure to the air. As they continue to abſorb gene from the acid in which they are diſſolved, or n the ſurrounding atmoſphere, the quantity of nitric l muſt alſo be very large; that it may be ſufficient, , to oxidate the metal,—ſecondly, to diſſolve the ox- If you employ only what is requiſite for the former poſe, you obtain only a dry oxide; as in the inſtan- of biſmuth, zinc, tin, and antimony.

he muriatic acid does not act upon any metal with- the aſſiſtance of water. Wherefore, as there are few metals which act upon water, there are but few ctly ſoluble in the muriatic acid; and nothing but rogenous gas is ever diſengaged, in the caſe of ſolu- , by this acid. Every thing concurs to ſhow, that the ciples of this acid adhere more obſtinately together, n thoſe of any other acid; and from this I am much ined to think, than the unknown baſe of the muria- acid, whatever it be, is the body which has the teſt poſſible affinity with oxigene. None of the buſtible bodies which detach that principle from the r ſubſtances that contain it, takes it from this acid: when metallic oxides are once formed, it diſſolves n very readily; it even detaches them from ſeveral r acids; and it diſſolves them even when fully ſaturated with oxigene; which the other acids are not c pable to do. The two laſt of theſe properties, which a very remarkable, certainly depend on the tendenc which the muriatic acid has to abſorb an exceſs of ox gene; a tendency ſo fully proved by the formation the oxigenated muriatic acid, &c. When the muria acid diſſolves metallic oxides that are too much oxidat to be diſſolved by the other acids, it begins with car ing off a portion of the oxigene from the oxides, a part of the water being diſengaged into oxigenated m riatic acid, the reſt diſſolves the remainder of the oxi that is leſs oxidated.

The action of the other acids on metals is not yet f ficiently known, to enable us to explain it ſo accurat We ſhall only remark, that metals cannot decompoſe t carbonic acid; for coal the radical principle of that cid, has a ſtronger affinity with oxigene, than oxig has with metals; as is proved by the decompoſition metallic oxides by the carbonaceous principle.

Laſtly, The precipitation of metallic oxides from cids, by other metallic ſubſtances, depends entirely the diverſity of the affinities of oxigene with theſe ſ ſtances. When copper precipitates oxide of ſilver, a iron, oxide of copper, in ſilver and copper; the rea of theſe phenomena is, that copper has a ſtronger affi ty with oxigene than ſilver, and iron than copper.

XI. We are only beginning to underſtand the for tion of the immediate principles of vegetables. It w long ago obſerved, that plants grew very well in p water; and that all their conſtituent principles w

for

rmed with water and atmoſpheric air: From theſe o ſources they derive all their nouriſhment: From eſe, their extract, mucilage, oil, coal, acids, colouring rts, &c. are produced. Since the diſcovery of the fferent gaſſes, it has been obſerved, that they grow ve- rapidly in air altered and mixed with carbonic acid, well as in hydrogenous gas. We have already taken tice, that leaves decompoſe water and carbonic acid. om the former, they abſorb hydrogene; and from e ſecond, carbone; diſengaging, from both, vital air. ey appear, likewiſe, to abſorb azote. Theſe well- own phenomena explain the formation of coal and oil: for there can be no doubt, that the latter of eſe principles conſiſts of hydrogene fixed by carbone, he expreſſion may be uſed, as it affords a good deal water during its combuſtion. But we are ſtill igno- t of the manner in which the colouring principle, e aroma, the fixed alkali, and the glutinous part, are med; and whence the varieties of the oils, &c. only we nture to foretel, that new experiments on vegetation, proſecution of theſe new views, will hereafter explain e nature and the compoſition of all theſe different im- diate principles.

We are now beginning to underſtand the formation vegetable acids, during vegetation, and even by that . In the hiſtory of acids, we have already taken no- e, that they appear to be all formed of ſimilar baſes: t, by a laſt analyſis, we obtain equally from them , carbone, hydrogene, and oxigene; and that they m to differ only in the proportions of the principles, d in the preſſure or denſity of the ſubſtances. The more we extend our experiments upon acids, the mo probable will this opinion become.

Scheele and M. Crell have found an analogy to exi among ſeveral of them. Scheele, who at firſt thoug the oxalic acid and the acid of ſugar to be differe from each other, was at length convinced, as we ha mentioned elſewhere, that there is no difference b tween theſe acids, but that they are preciſely the ſam —1. By extracting the portion of potaſh which co ceals the properties of the oxalic acid in common ſalt ſorrel, and, by that means, reducing it to pure oxa acid ; 2. By changing acid of ſugar into ſalt or ſorr by the addition of a little potaſh.

If to this moſt important fact in the analyſis of veg tables, we add the valuable experiments of M. Cre who has extracted tartareous acid from alcohol, and h changed tartareous acid into vinegar, and into oxa acid, and oxalic acid, again, into acetous acid,—we ſh ſee, that the oxalic, the tartareous, and the acetous cids, greatly reſemble each other: that they are form from one baſe, and differ only in the proportions of t oxigene which they contain. It appears that the t tareous acid contains leaſt of this principle: that t oxalic acid contains a good deal more of it ; and t the acetous acid contains ſtill more than either of t other two. I cannot help thinking, that if four ve table acids, which were at firſt thought to be eſſentia different from each other, have been already found conſiſt of the ſame baſe, combined with different p portions of oxigene ; future experiments may in l manner diſcover the ſame analogy to ſubſiſt among thers, particularly between the citric and malic ac

wh

hich are ſo often found together in vegetable juices. heſe aſſertions are ſupported by ſome experiments on he analyſis of the quinquina of St Domingo, which re inſerted in one of the volumes of the Annals of Che- iſtry.

Laſtly, Our preſent knowledge of the theory of vege- tion, already explains to us the influence of manures. I. Parmentier is the firſt and almoſt the only natural hiloſopher that has begun to apply this theory to agri- lture, in a memoir which he read to the Agricultural ciety of Paris, in June 1791.

XII. Spiritous fermentation,—the ſimultaneous for- ation of the carbonic acid and alcohol,—the neceſſity water and a ſaccharine principle to begin that fer- entation,—all together afford us reaſon to think, that s produced by the decompoſition of water. The oxi- ne of the water combining with the coal, forms carbo- acid, which is diſengaged; and the alcohol is form- by the fixation of the hydrogene in the oily baſe, ich, with different quantities of oxigene, forms the tareous, the oxalic, and the acetous acids. This the- y explains fully the reaſon why alcohol affords ſo ch water in combuſtion,—why it is changed by mi- al acids into oxalic acid, acetous acid, &c. It is true, do not yet well underſtand how it paſſes into the e of æther; only it is probable that, in ſuch opera- ns, the alcohol loſes a portion of its oxigene, which s to the formation of water.

XIII. Chemiſts are beginning to conjecture, how far ſcience can conduct them in their enquiries into the formation of animal matters. Digeſtion ſeems to be ſimply an extraction or ſolution by the gaſtric juice. The fixation of gas azote is one of the principal functions of organization. From the experiments of Scheele, and, ſtill more, from thoſe of M. Berthollet, it appears to occaſion the principal difference between animal matters and vegetable ſubſtances. It contributes to the formation of the ammoniac which theſe ſubſtances afford in ſuch abundance by diſtillation, &c. Reſpiration appears to be one of the moſt powerful means employed by nature for increaſing the quantity of azote in animal ſubſtances. The differences among the animal fluids deſigned for the nouriſhment of the different organs, and the peculiar nature of the gelatinous humour, of the albuminous liquor, and of the fibrous part, which is melted and diſſolved in certain fluids, are now ſufficiently aſcertained. We know that the former is th leaſt animaliſed,—that the ſecond is more ſo,—and tha the third is the laſt ſubſtance produced by the action o the vital functions upon the fluids: We know, alſo that this laſt humour is reunited ſimply by reſt into tiſſue of ſolid fibres; and that the albuminous part i thickened, and rendered concrete by heat; wherea the gelatinous ſubſtance is ſooner decompoſed, bu alſo more readily reproduced. Peculiar acids hav been found in the excrementitious humours; but w know nothing of their formation: we are particularl ignorant of the manner in which the phoſphoric aci which abounds ſo generally throughout this kingdom, formed.

The nature of the ſolids of animals has engaged t attention of modern chemiſts. The diſtinctive natu

of the fibrous texture of the muſcles,—of the membra-
nous plates,—of the hard laminæ of the bones, &c.
s now known. Medicine expects from the diſcoveries
of chemiſtry, a ſolution of the problems which ſtill ſub-
iſt concerning the formation of the ſeveral matters
hich conſtitute theſe parts ; eſpecially the phoſphoric
cid, the albuminous juice, the fibrous matter, calcare-
us phoſphate, and the peculiar oils which are found in
his kingdom of nature. The formation of ammoniac,
hich was gueſſed at by Bergman and Scheele, and has
een ſince fully explained by M. Berthollet, affords us
aſon for thinking, that all theſe problems may be ſuc-
ſſively ſolved. In all probability, we want only a few
incipal facts, to enable us to reach ſeveral important
ſults: The hope of this muſt encourage thoſe phyſi-
ans who know the importance of chemiſtry.

XIV. Ever ſince the days of Chancellor Bacon, the
ſtory of putrefaction has been acknowledged as an im-
rtant object in medical enquiries. Several eminent
turaliſts have ſtudied it with ſome ſucceſs: But the
uſe of this decompoſition, and the manner in which
is effected, have not been yet diſcovered. The late
ſcoveries throw ſome light on this important point.
ater, which promotes and excites putrefaction, is un-
rſtood to be decompoſed in that inteſtine emotion.
e underſtand how ammoniac is formed in ſuch abun-
nce,—by the fixation of azotic gas and hydrogenous gas.
e ſlow decompoſition of greaſe, its preſervation and
ndenſation, of which the laſt in ſome inſtances proceeds
ſolidity and hardneſs in conſequence of the fixation of
al air from water, are now accounted for: In like

manner have been explained, the volatilization and reduction of animal ſubſtances expoſed to the air into elaſtic fluids; in a word, the complete ſeparation of all thoſe principles, and their diſperſion in the atmoſphere, which conveys them into new combinations; with that whole ſeries of compoſitions, and tranſitions of ſubſtances out of one kingdom into another,—ſo happily expreſſed by Beccher under the philoſophical emblem, *circulus æterni motus*, which he uſes to ſignify the indefatigable activity of nature.

EXPLANATION

OF THE

TABLE OF THE NOMENCLATURE.

WE ſhall begin with obſerving, that it was not our intention to exhibit, in this Table, the whole f the chemical nomenclature: Our deſign was only to rrange together, under ſeveral claſſes of compounds, ıch a number of ſelect examples as might enable any erſon, with a little ſtudy, to apply the principles of ur ſyſtem of nomenclature to all the compounds with hich chemiſts are at preſent acquainted, as well as to hoſe which may be hereafter diſcovered. For this puroſe, we have divided the table into ſix perpendicular olumns, with the general titles at their heads, expreſng the ſtate of the bodies whoſe names they contain. ach of theſe columns conſiſts of 55 diviſions,—that beg the number of the undecompoſed ſubſtances with hich we are acquainted, and which ſucceed in order n the firſt column. The correſpondent horizontal diiſions of the other five columns, comprehend the prinipal combinations of thoſe ſimple ſubſtances, and muſt f conſequence be equally numerous.

We ſhall trace each of theſe columns through its prinipal diviſions.

COLUMN I.

The title of the firſt column is SUBSTANCES THA HAVE NOT YET BEEN DECOMPOSED. The reaſon wh we conſider theſe bodies as ſimple, is, that we have no yet been able to analyſe them. All the accurate exp riments which have been performed during theſe la ten years, concur to ſhew, that theſe bodies can neithe be ſeparated into more ſimple ſubſtances, nor reprodu ced by artificial combinations. Theſe ſubſtances ar as we have already mentioned, 55 in number. The with their correſponding compounds are numbered wi Arabic numerals, running down both the right and le ſides of the table.

The 55 ſimple ſubſtances of the firſt column are d vided into five claſſes, according to the differences their nature. The firſt of theſe claſſes conſiſts of fo bodies, which appear to come nearly under the chara ter that has been aſſigned to the elements, and act t moſt important part in combinations. Theſe are, *Light:* 2. *Caloric*, which has hitherto been nam matter of heat: 3. *Oxigene*, or that part of vital which becomes fixed in burning bodies, augments th weight, and changes their nature, and of which t moſt eminent property being to conſtitute acids, has i duced us to give it a name alluding to that remarkab characteriſtic: 4. *Hydrogene*, or the baſe of the elaſ fluid which is called Inflammable Gas, and which, as is one of the principles of water, exiſts in ice, in a fo ſtate. Theſe firſt four principal bodies are connec by a brace.

The ſecond claſs of the undecompoſed ſubſtances,

e firſt column, conſis of 26 different bodies,—all of
hich are liable to become acid, by combining with
igene; and in conſequence of their poſſeſſing this
aracteriſtic in common, we diſtinguiſh them by the
me of *acidifiable baſes*. There are only four of theſe
6 bodies that can be obtained in a ſimple uncombined
te. Theſe four are, *azote*,—the *radical principle* of
e nitric acid *, or the ſolid baſe of atmoſpheric me-
itis, well known at preſent to chemiſts, in the fifth
viſion; *pure coal*, *carbon*, or the *radical principle* of
e carbonic acid, in the ſixth diviſion; *ſulphur*, or the
dical principle of the ſulphuric acid, in the ſeventh
viſion; and *phoſphore*, or the *radical principle* of the
oſphoric acid, in the eighth diviſion. The other 22
e only known as they exiſt in combination with oxi-
ne, and in the ſtate of acids. But in order to extend
d ſimplify the Science, we have ſuppoſed them ſe-
rated from oxigene, and exiſting in that pure ſtate to
ich it is probable they may one day or other be re-
ced by art. They are all, therefore, inſerted in the
t column, as exiſting in this ſuppoſed ſimple ſtate,
d diſtinguiſhed as the radical principles of the acids
o which they enter.

The third claſs of the undecompoſed ſubſtances of
e firſt column, conſiſts of metallic matters, in number
, extending from the 31ſt to the 47th diviſion, *inclu-*
. They all retain the names by which they have
n hitherto known. The three firſt are liable to paſs

into

It is alſo to be obſerved, that azote is never obtained in a ſepa-
inſulated ſtate, but always in a gazeous ſtate, and in combination
caloric.

into an acid ſtate,—agreeing, in this characteriſtic, wi the preceding acidifiable baſes.

In the fourth claſs, are the earths which have n yet been decompoſed,—*ſiliceous earth*, *aluminous ear* *barytes*, *lime*, and *magneſia*, in ſo many ſucceſſive di ſions. None of theſe five earths has yet been decon poſed; and they are therefore to be conſidered, in t preſent ſtate of our knowledge, as ſo many ſimple b dies.

Laſtly, the fifth claſs of undecompoſed ſubſtanc conſiſts of the three alkalis,—*potaſh*, *ſoda*, and *ammoni* The laſt of theſe ſubſtances has been decompoſed Meſſrs Bergman and Scheele; and M. Berthollet h determined, in a preciſe manner, the nature and t quantity of its principles: But we were unwilling to parate it from the fixed alkalis, the component prin ples of which we hope alſo to diſcover in a ſhort tim It would be improper to break through the order, a overlook the mutual relations of thoſe ſubſtances, whi in many reſpects act, in chemical experiments, as und compoſable matters.

The firſt column, all the diviſions of which we ha now explained, is, like each of the others, divided lo gitudinally into two; the left ſide exhibits the names of the ſubſtances in Italic characters.

COLUMN II.

The ſecond column is intituled, THE SAME S STANCES REDUCED INTO THE STATE OF GAS, BY T ADDITION OF CALORIC. It exhibits the perman aëriform ſtates into which a number of the ſimple ſ

ſtan

ances in the firſt column are liable to paſs. In this olumn, there are only four elaſtic fluids, the names f which, like all the words in the other columns, are erived from the names of the undecompoſable matters, nd are rendered ſufficiently intelligible, by the addition f the word *gas* to the correſpondent words in the firſt olumn:—*Oxigenous gas, hydrogenous gas, gas azote,* nd *ammoniacal gas.*

COLUMN III.

The title of the third column informs the reader, hat it conſiſts of THE SAME SUBSTANCES which apear in the firſt column, COMBINED WITH OXIGENE. his is one of the fulleſt columns in the Table; for, aloſt all the bodies in the firſt column are capable of ombination with oxigene. The names in it are all ompounded of two words, expreſſive of the two maters of which the ſubſtances to which they belong, conſt. The firſt of theſe words, is the generic term of he acid, which indicates the ſaline character that it deives from oxigene: The ſecond peculiariſes each acid, nd refers to its peculiar radical principle. The 5th diiſion of this third column exhibits the combination of *zote*, or *nitric radical*, with oxigene. From that comination ariſe three compounds, produced by a diverſity n the proportions of the principles: The azote is either nited with the leaſt poſſible quantity of oxigene, and t then forms the *baſe of nitrous gas*;—or ſaturated ith it, and then it conſtitutes *nitric acid*;—or uited with leſs than in nitric acid, yet with more than n nitrous gas, and then it forms *nitrous acid*. We expreſs the three different ſtates of this combinatio ſimply by varying the termination of the ſame word In the ſame manner, the termination of the *ſulphuri* *acid* is varied in the 7th diviſion; that of the *phoſphori* *acid*, in the 8th diviſion; and that of the *acetic acid*, i the 13th. Theſe acids exiſt in two ſtates of combination with oxigene, according to the quantities whic their acidifiable baſes contain. When the baſes ar completely ſaturated, the acids produced are, the *ſu* *phuric*, the *acetic*, and the *phoſphoric:* When th baſes are not ſaturated, and do not contain oxigen in a due proportion, we call the acids that are the formed, the *ſulphureous*, the *acetous*, and the *phoſphorous*. We have followed the ſame general rul in the denomination of all the other acids. Whe an acid is known only in one ſtate, and, in that ſtat the baſe is fully ſaturated with oxigene, ſuch as th carbonic or the boracic acid, its name then terminate in *ic:* when it is known in two ſtates, it is diſtinguiſhed, in the ſtronger ſtate, by the termination *ic*; i the weaker, or that in which there is an exceſs o the acidifiable baſe, its name terminates in *ous*. Accordingly, in thoſe acids which are known only i one ſtate, and yet have their names terminating i *ous*, it may be underſtood that there is an exceſs of th acidifiable baſe: ſuch are, the *tartareous* acid, in th 14th diviſion; *pyro-tartareous*, in the 15th; the *pyro* *ligneous*, in the 21ſt; and the *pyro-mucous*, in the 22d The *muriatic* acid, in the 9th diviſion, is in a ſtat different from any of the others. Beſide its combination, in which it is ſaturated with oxigene, it is alſo capable of receiving an exceſs of oxigene, which commu ates to it ſome remarkable properties. To diſtinguiſh s it exiſts in this laſt ſtate, we call it the *oxigenated riatic acid ;* and the epithet *oxigenated*, may be in manner applied to any of the other acids that ſhall found exiſting in the ſame ſtate. The lower diviſions this third column, from the 31ſt to the 47th *incluſive*, ibit the nomenclature of another ſyſtem of bodies. The word *oxide* is there found at the beginning of the npound denomination. The reaſon which induced us ſubſtitute this name to that of metallic calces, has been lained in our memoir on this nomenclature. It does expreſs a ſaline quality, as the word *acid* does, and yet otes a combination of oxigene: and it may be applied ll bodies that are ſuſceptible of a combination with gene without paſſing into a ſtate of acidity; and this, ther their not becoming acid be owing to the ſcanty portion of the oxigene, or to the nature of their ba- Thus, for inſtance, the phoſphoric acid, vitrified, eprived of a part of its oxigene, by the action of a ng heat, becomes a ſort of *phoſphoric oxide*. Nitrous , too, which is not more acid than phoſphoric glaſs, roperly a *nitrous oxide*; and hydrogene, in combina- with oxigene, forms not an acid, but water, which, his light, may be conſidered as an *oxide of hydro- e*.

f the 17 metallic oxides, between the 31ſt and the h diviſion, there are 3 which are only in intermediate es between the metallic and the acid. It is for want xigene that the oxides of arſenic, molybdena, and gſten, in the 31ſt, the 32d, and the 33d diviſions, are yet become acid. A greater quanity of the acidify- principle conſtitutes them the *arſenic*, the *molybdic*, and the *tunſtic* acids. Epithets taken from colour ſer to diſtinguiſh the different oxides of the ſame metal, may be obſerved of the oxides of antimony, lead, a mercury.

COLUMN IV.

THE 4th column, intituled, THE SAME SUBSTANC IN A GAZEOUS OXIGENATED STATE, contains ſimple ſu ſtances combined both with oxigene and with a ſuffi ent quantity of caloric to reduce them to perman gaſes, under the uſual preſſure and temperature of t atmoſphere. There are only ſix ſubſtances known exiſt in this ſtate,—*nitrous gas*, *nitrous acid gas*, *car nic acid gas*, *ſulphureous gas*, *muriatic* and *oxigena muriatic acid gas*, and *fluoric acid gas*.—No other oxi nated ſubſtance having been reduced into a gazeous ſt by caloric, we have therefore introduced into this colu ſome peculiar combinations of metallic oxides, or oxi nated metals, with different baſes: It is accordingly vided in the middle; and the lower part intituled, M TALLIC OXIDES WITH DIFFERENT BASES.—From 31ſt to the 45th diviſion *incluſive*, are the combinati of metallic oxides with ſulphur and alkalis. The f mer are called *ſulphurated oxides* of arſenic, lead, & the latter, *alkaline metallic oxides*. When any of th compounds varies in the proportions, and conſequen in its properties, we diſtinguiſh it in the ſame man as the ſimple oxides, by epithets taken from colo thus we ſay, *grey*, *red*, *orange*, &c. *ſulphurated oxi of antimony*.

COLUMN V.

THE 5th column, conſiſting of the ſimple SUBTANCES, in the 1ſt column, OXIGENATED AND NEURALISED BY THE ADDITION OF BASES, or, neutral lts in general, exhibits many more names than any the preceding columns; becauſe we have thought it eceſſary to give, in this column, a greater number of amples, in order to ſhow the ſuperiority of this ſyſtem nomenclature over the ancient names; moſt of which, ough expreſſing ſimilar combinations, were in nowiſe nalogical.

Any perſon may ſee, by looking ſlightly over this comn, that the names contained in it, and expreſſing ſiilar combinations, have all one termination. It is eaſy ſee, that this muſt greatly facilitate the ſtudy of the ience, and contribute greatly to the perſpicuity of orks of chemiſtry in which this mode of denomination all be adopted. The bodies belonging to this column e compounds of three ſubſtances,—acidifiable baſes, e acidifying principle, or oxigene, and terrene, metalc, or alkaline baſes. But we uſe only two words to xpreſs their nature; for, the firſt of theſe being deved from the name of the oxigenous or acid combinaon, ſerves to denote that combination; the other refers lely to the baſe with which the acid is ſaturated. The ames of all theſe compounds terminate in *ate*, when hey contain acids completely ſaturated with oxigene: ut when the acids are not completely ſaturated with hat principle, the name of the neutral ſalt then termiates in *ite*. We have given more inſtances of neutral ſalts formed from thoſe acids which are beſt known a moſt uſed, than of the ſalts formed with the acids whi are leſs common *.

The names of 18 genera of neutral ſalts in this ta terminate in *ate*. This termination of their name ſhe that the acid to which they owe their formation is kno only in the ſtate of the complete ſaturation of its acidi ble baſe with oxigene: and accordingly, the names all the acids to which theſe neutral ſalts belong, term nate in *ic*, by the rules of our nomenclature, as appe in the 3d column.

The 14th, 15th, 21ſt, and 22d, diviſions, exhi names of neutral ſalts, terminating in *ite*. The term

nati

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* The neutral ſalts are now exceedingly numerous. There are acids known, which, as each of them may be ſaturated by 4 ſol earths, 3 alkalis, and 14 metallic oxides which are not acidifiable (it appears, that the acidifiable oxides, ſuch as thoſe of arſenic, moly dena, and tungſten, do not neutraliſe the mineral acids), form 609 ſ cies of compound ſalts. Add to this, that 5 of theſe acids, the nitr the ſulphuric, the muriatic, the acetic, and the phoſphoric, combi with neutraliſable baſes in both of their different ſtates; and that a nu ber of acids, ſuch as the ſulphureous, the tartareous, the oxalic, a the arſenic, admit of ſaturation with different quantities of the ba in conſequence of which they form what are called *acidula*, of whi there are already 8 different ſpecies very well known *. With this a dition, the number of the neutral ſalts will amount to 722 ſpecies, t names of which may be methodically formed, from the 46 or 48 e amples given in this table.

* Such are, *acidulous ſulphate of potaſh*, or vitriolated tartar with an exceſs of acid; *tartarites*, or *acidulous oxalates of potaſh*, *ſoda*, and *ammoniac*, or creams of t tar, and ſalts of ſorrel, artificially prepared with the pure tartareous and ox acids combined with a ſmall quantity of the alkaline baſes; and the *acidulous a nic of potaſh*, or arſenical neutral ſalt of Macquer.

tion of theſe ſalts is meant to indicate, that in the a-
ls from which they are formed, there is an exceſs of
e acidifiable baſe.

There are other diviſions in this column, exhibiting
th the terminations *ate* and *ite:* thus, in the 5th co-
mn, *nitrate* and *nitrite;* in the 7th *ſulphate*, and *ſul-*
ite; in the 8th, *phoſphate* and *phoſphite;* in the 13th,
tate and *acetite*. Theſe terminations ſhew, that the
ts to which they belong owe their formation to acids
iſting in two different ſtates. *Nitrates*, for inſtance,
formed by the *nitric* acid, in which the acidifiable
ſe is fully ſaturated with oxigene; and *nitrites* again
formed by the *nitrous* acid, in which the baſe is not
mpletely ſaturated with the acidifying principle.

In ſome others of theſe diviſions, there are neutral
ts different from any of the above. Thus, in the 9th
viſion, we have *oxigenated muriate of potaſh*, the com-
nation of the oxigenated muriatic acid of potaſh, a ſalt
ry different from ſimple muriate with potaſh, and
ich M. Berthollet has diſcovered to poſſeſs the pro-
rty of detonizing on burning coals. In other diviſions
this ſame column, we have expreſſed ſaline combina-
ns in which the acids predominate, by adding to the
ſtematic name of theſe ſalts, the epithet *acidulous:*
us, the 14th diviſion contains *acidulous tartarite of*
taſh; and the 16th, *acidulous oxalate of potaſh*. Laſt-
, by the expreſſion *ſuperſaturated*, we diſtinguiſh thoſe
utral ſalts in which the baſe predominates, as may be
n in the 8th diviſion, in which is, *ſuperſaturated phoſ-*
ate of ſoda; and in the 10th, in which we have borax,
ſuperſaturated borate of ſoda.

By reflecting on the ſtrict etymological method which we have obſerved in affixing theſe denominations neutral ſalts; and conſidering, that, in the old nome clature, there appears ſcarce any analogy between t names of ſalts of a ſimilar nature; the Reader w perceive the reaſon of the changes which appear in t column, which are more numerous than thoſe whi any of the others exhibits; though there is actually n thing new in it, but the variation of two terminati of names which were before in uſe.

COLUMN VI.

The ſixth and laſt column of this table, which co prehends ſimple ſubſtances combined in their natu ſtate, and neither oxigenated nor acidified,—as the ti ſhews, is one of the ſhorteſt, and contains but few co pounds. The lower diviſions, from the 31ſt to the 48 contain compounds conſiſting of different metals, whi we ſuffer to retain the names of *alloys* and *amalgams*, which they have been hitherto known. Above the 3 diviſion, there are only three which exhibit a new n menclature, founded on the ſame principles with t foregoing. The ſixth contains *carbure of iron*;—a d nomination by which we have diſtinguiſhed the n tural combination of coal and iron, called *plumbag* The 7th diviſion exhibits metallic ſulphures, or natu combinations of ſulphur with metals,—alkaline ſulph res, or combinations of ſulphur with alkalis and ſulph rated hydrogenous gas, or the ſolution of ſulphur in h drogenous gas. Laſtly, in the 8th diviſion, we expre by the generic name of *metallic phoſphures*, natural co pounds of phoſphorus with metals: Thus, to the na

ſyder

rite, we ſubſtitute the expreſſion *phoſphure of iron*,
ch plainly ſignifies the combination of phoſphorus
iron: and theſe three words *carbure*, *ſulphure*, and
phure, differing only in the termination from names
ch are very well known, convey an accurate idea of
lar combinations, and diſtinguiſh them from all other
pounds.

elow theſe ſix columns, we have placed a nomen-
ure of the principal compound bodies that are found
egetables. In this part of the table, we have mere-
lected from among the old names, thoſe whoſe ſim-
ity and plainneſs render them ſuitable to our pur-
s.

uch is the method which we have followed in form-
the ſyſtem of names exhibited in this table. Thoſe
make themſelves maſters of this table, which may
eaſily be done, will readily perceive, that we have
ned but very few new words, excepting ſuch as were
ſpenſably neceſſary to denominate ſubſtances before
nown, ſuch as the newly-diſcovered acids. By tra-
the order of the ſubſtances in the firſt column,
which all the reſt are derived, any perſon will ſee,
we uſe no new words but *oxigene*, *hydrogene*, and
e. As to the words *caloric*, *carbone*, *ſilice*, *ammoniac*,
theſe and all their derivations are formed by a very
t change from names before well known and much
d. It is plain, therefore, that our new nomenclature
ers from the old, in nothing but new terminations;
if theſe changes render the ſtudy eaſier, and the
uage of the ſcience more intelligible,—above all, if
enable us to expreſs ourſelves with unequivocal pre-
on,—as the trial of this nomenclature that has been
made

made in the courſe of Lectures on Chemiſtry delivere the King's Garden and the Lyceum, affords us reaſ hope;—the reformation which we wiſh to introduce ſo ſimple a method, cannot but be highly favourabl the progreſs of Chemiſtry.——The experience of th years, during which period I have now taught this menclature, as well as the teſtimony of all my pu have confirmed the hopes which I formerly entertai *ture.*

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ADV

A TABLE, EXHIBITING THE CHEMI

Propoſed by Meſſieurs De MORVEAU, LAVOISIER, BERT

		I.		II.		III.		
		SUBSTANCES THAT HAVE NOT BEEN YET DECOMPOSED.		THE SAME SUBSTANCES REDUCED INTO THE STATE OF GAS BY THE ADDITION OF CALORIC.		THE SAME SUBSTANCES COMBINED WITH OXIGENE.		THE SAM GEN
		NAMES NEWLY INVENTED OR ADOPTED.	ANCIENT NAMES.	NAMES NEWLY INVENTED OR ADOPTED.	ANCIENT NAMES	NAMES NEWLY INVENTED OR ADOPTED.	ANCIENT MAMES.	NAMES NE TED OR
1		Light - -	— —	— —	—	— —	—	—
2		Caloric - -	*Latent heat,* or *matter of heat.*	— —	—	— —	—	—
3		Oxigene - -	*The baſe of vital air.*	Oxigenous gas. *N.B.* It appears that light contributes to the reduction of oxigene into a gazeous ſtate.	*Dephlogiſticated* or *vital air.*	— —	—	—
4		Hydrogene.	*The baſe of inflammable gas.*	Hydrogenous gas.	*Inflammable gas.*	Water.	*Water.*	—
5	ACIDIFIABLE BASES.	Azote, *or* the radical principle of the nitrid acid.	*The baſe of phlogiſticated air,* or *of atmoſpheric mephitis.*	Gas azote.	*Phlogiſticated air,* or *atmoſpheric mephitis.*	The baſe of nitrous gas. Nitric acid. *With an exceſs of azote,* Nitrous acid.	*The baſe of nitrous gas.* *White nitrous acid.* *Fuming nitrous acid*	Nitrous gas Nitrous aci
6		Carbone, *or* the radical principle of the carbonic acid.	*Pure coal.*	— —	—	Carbonic acid.	*Fixed air,* or *cretaceous acid.*	Carbonic ac
7		Sulphur, *or* the radical principle of the ſulphuric acid.	— —	— —	—	Sulphuric acid. *With leſs oxigene,* Sulphureous acid.	*Vitriolic acid.* *Sulphureous acid.*	 Sulphureou
8		Phoſphore, *or* the radical principle of the phoſphoric acid.	— —	— —	—	Phoſphoric acid. *With a ſmaller proportion of oxigene,* Phoſphorous acid.	*Phoſphoric acid.* *Fuming,* or *volatile phoſphoric acid.*	—
9		Radical principle of the muriatic acid.	— —	— —	—	Muriatic acid. - *With an exceſs of oxigene.* Oxigenated muriatic acid	*Marine acid.* *Dephlogiſticated marine acid*	Muriatic aci Oxigenated acid gas
10		Radical principle of the boracic acid.	— —	— —	—	Boracic acid.	*Sedative ſalt.*	—
11		Radical principle of the fluoric acid.	—	— —	—	Fluoric acid. -	*Acid of ſpar.*	Fluoric acid
12		Radical principle of the ſuccinic acid.	—	— —	—	Succinic acid.	*Volatile ſalt of amber.*	—
13		Radical principle of the acetic acid.	— —	— —	—	Acetous acid. - *With more oxigene,* Acetic acid. -	*Diſtilled Vinegar.* *Radical vinegar.*	—
14		Radical principle of the tartareous acid.	— —	— —	—	Tartareous acid.	— —	—
15		Radical principle of the pyro-tartareous acid.	— —	— —	—	Pyro-tartareous acid.	*Empyreumatic tartareous acid,* or *ſpirit of tartar.*	—
16		Radical principle of the oxalic acid.	-- —	— —	—	Oxalic acid.	*Saccharine acid.*	—
17		Radical principle of the gallic acid.	— —	— —	—	Gallic acid. -	*Aſtringent principle.*	—
18		Radical principle of the citric acid.	— —	— —	—	Citric acid. -	*Lemon juice.*	—
19		Radical principle of the malic acid.	— —	— —	—	Malic acid. -	*Acid of apples.*	—
20		Radical principle of the benzoic acid.	— —	— —	—	Benzoic acid. -	*Flowers of benzoin.*	—
21		Radical principle of the pyro-ligneous acid.	— —	— —	—	Pyro-ligneous acid.	*Spirit of wood.*	—
22		Radical principle of the pyro-mucous acid.	— —	— —	—	Pyro mucous acid.	*Spirit of honey, ſugar,* &c.	—
23		Radical principle of the camphoric acid.	— —	— —	—	Camphoric acid.	— —	—
24		Radical principle of the lactic acid.	— —	— —	—	Lactic acid -	*Acid of milk.*	—
25		Radical principle of the ſaccho-lactic acid.	— —	— —	—	Saccho-lactic acid.	*Acid of ſugar of milk.*	—
26		Radical principle of	— —	— —	—	Formic acid. -	*Acid of ants.*	—

EMICAL NOMENCLATURE

R, BERTHOLLET, and De FOURCROY, in May 1787.

	IV. THE SAME SUBSTANCES IN AN OXIGENATED GAZEOUS STATE.		V. THESE OXIGENATED SUBSTANCES NEUTRALIZED BY THE ADDITION OF BASES.		VI. THE SAME PRIMARY SUBSTANCES COMBINED WITH OTHER SUBSTANCES, BUT NOT ACIDIFIED.		
ED	NAMES NEWLY INVENTED OR ADOPTED.	ANCIENT NAMES.	NAMES NEWLY INVENTED OR ADOPTED.	ANCIENT NAMES.	NAMES NEWLY INVENTED OR ADOPTED.	ANCIENT NAMES.	
	—	— —	—	— —	—	— —	1
	—	— —	—	— —	—	— —	2
	—	— —	—	— —	—	— —	3
	—	— —	—	— —	—	— —	4
r.	Nitrous gas. Nitrous acid gas.	— —	Nitrate of potaſh. of ſoda, &c. Nitrite of potaſh.	*Common nitre.* *Cubic nitre.*	—	— —	5
ous	Carbonic acid gas.	*Fixed air, mephitic air.*	Carbonate of lime. of potaſh, &c. of iron, &c.	*Chalk.* *Effervescent alkalis.* *Ruſt of iron, &c.*	Carbure of iron.	*Plumbago.*	6
	Sulphureous acid gas.	*Sulphureous acid gas.*	Sulphate of potaſh. of ſoda. of lime. of alumine. of barytes. of iron, &c. Sulphite of potaſh, &c.	*Vitriolated tartar* *Glauber ſalt.* *Selenite.* *Alum.* *Ponderous ſpar.* *Vitriol of iron.* *Stahl's ſulphureous ſalt.*	Sulphure of iron. of antimony of lead. Sulph hydrogenous gas. Sulphure of potaſh. Sulphure of ſoda. Alkal. ſulphures with metals ſuſpended in them. Alkaline ſulphure with carbonaceous matters ſuſpended in it.	*Factititious iron pyrites* *Antimony.* *Galena.* *Hepatic gas.* *Alkaline livers of ſulphur.* *Metallic livers of ſulphur.* *Liver of ſulphur with carbonaceous matters ſuſpended in it.*	7
f	—	— —	Phoſphate of ſoda. Calcareous phoſphate. Superſaturated phoſphate of ſoda. Phoſphite of potaſh, &c.	*Phoſphoric ſalt, with a baſe of natrum.* *Earth of bones.* *Haupt's ſal perlatum.*	Phoſphoriſed hydrogenous gas. Phoſphure of iron.	*Phoſphoric gas.* *Syderite.*	8
e	Muriatic acid gas. Oxigenated muriatic acid gas	*Marine acid gas.* *Dephlogiſticated marine acid gas.*	Muriate of potaſh. Muriate of ſoda. Calcareous muriate, &c. Ammoniacal muriate. Oxigenated muriate of ſoda, &c.	*Febrifuge ſalt of Sylvius.* *Marine ſalt.* *Calcareous marine ſalt.* *Sal ammoniac.*	—	— —	9
	—	— —	Borate ſuperſaturated with ſoda, *or* borax. Borate of ſoda, &c. *ſoda ſaturated with the acid.*	*Common borax.*	—	— —	10
	Fluoric acid gas.	*Spathoſe gas.*	Fluate of lime, &c.	*Fluor ſpar.*	—	— —	11
	—	— —	Succinate of ſoda, &c.		—	— —	12
	—	— —	Acetite of potaſh. of ſoda. of lime. of ammoniac. of lead. of copper. Acetate of ſoda, &c.	*Terra foliata tartari.* *Mineral terra foliata.* *Calcareous acetous ſalt.* *Spirit of Mendererus.* *Sacharum ſaturni.* *Verdegris.*	—	— —	13
	—	— —	Acidulous tartarite of potaſh. Tartarite of potaſh. Tartarite of ſoda, &c.	*Cream of tartar.* *Vegetable ſalt.* *Salt of Seignette.*	—	— —	14
f	—	— —	Pyro-tartarite of lime. Pyro-tartarite of iron, &c.	— —	—	— —	15
	—	— —	Acidulous oxalate of potaſh. Oxalate of lime. of ſoda, &c.	*Salt of Sorrel.*	—	— —	16
	—	— —	Gallate of ſoda. of magneſia. of iron, &c.	— —	—	— —	17
	—	— —	Citrate of potaſh. of lead. &c.	*Terra foliata with lemon juice.*	—	— —	18
	—	— —	Malate of lime, &c.	— —	—	— —	19
	—	— —	Aluminous benzoate. Benzoate of iron, &c.	— —	—	— —	20
	—	— —	Pyro-lignite of lime. Pyro lignite of zinc, &c.	— —	—	— —	21
,	—	— —	Pyro-mucite of magneſia. Ammoniacal, &c. pyro-mucite.	—	—	— —	22
	—	— —	Camphorate of ſoda, &c.	— —	—	— —	23
	—	— —	Lactate of lime, &c.	— —	—	— —	24
	—	— —	Saccho-lactate of iron, &c.	— —	—	— —	25
	—	— —	Ammoniacal, &c. for-	*Spirit of magnanimity.*	—	— —	26

21		Radical principle of the pyro-ligneous acid	— —	—	—	—	Pyro-ligneous acid.	*Spirit of wood.*	—
22		Radical principle of the pyro-mucous acid.	— —	—	—	—	Pyro mucous acid.	*Spirit of honey, ſugar,* &c.	—
23		Radical principle of the camphoric acid.	— —	—	—	—	Camphoric acid.	— —	—
24		Radical principle of the lactic acid.	— —	—	—	—	Lactic acid	*Acid of milk.*	—
25		Radical principle of the ſaccho-lactic acid.	— —	—	—	—	Saccho-lactic acid.	*Acid of ſugar of milk.*	—
26		Radical principle of the formic acid.	— —	—	—	—	Formic acid.	*Acid of ants.*	—
27		Radical principle of the Pruſſic acid.	— —	—	—	—	Pruſſic acid.	*Colouring matter of Pruſſian blue.*	—
28		Radical principle of the ſebacic acid.	— —	—	—	—	Sebacic acid.	*Acid of greaſe.*	—
29		Radical principle of the lithic acid.	— —	—	—	—	Lithic acid	*Stone in the bladder.*	—
30		Radical principle of the bombic acid.		—	—	—	Bombic acid.	*Acid of the ſilk-worm.*	—
31	METALLIC SUBSTANCES.	Arſenic.	*Regulus of arſenic.*	—	—	—	Oxide of arſenic. *With more oxigene.* Arſenic acid	*White arſenic*, or *calx of arſenic.* *Arſenical acid.*	OXIDES Yellow { ſu Red { o a Arſenicalox Sulphureof
32		Molybdena.	— —	—	—	—	Oxide of molybdena. Molybdic acid.	*Calx of molybdena.*	
33		Tungſten.	— —	—	—	—	Oxide of tungſten. Tunſtic acid.	*Yellow calx of tungſten.*	—
34		Manganeſe.	*Regulus of manganeſe.*	—	—	—	White Black Vitreous } oxide of manganeſe.	*Manganeſe.*	—
35		Nickel.	— —	—	—	—	Oxide of nickel.	*Calx of nickel.*	—
36		Cobalt	*Regulus of cobalt.*	—	—	—	Grey Vitreous } oxide of cobalt.	*Calx of cobalt*	Alkaline col oxides.
37		Biſmuth.	— —	—	—	—	White Yellow Vitreous } oxide of biſmuth.	*Magiſtery of biſmuth,* or *white paint.* *Yellow calx of biſmuth.* *Glaſs of biſmuth.*	Sulphurated biſmuth.
38		Antimony	*Regulus of antimony.*	—	—	—	White oxide of antimony { by the nitrous acid. by the muriatic acid ſublimated. vitreous.	*Diaphoretic antimony.* *Powder of Algarotti.* *Flowers,* or *ſnow of antimony.* *Glaſs of regulus of antimony.*	Grey Red Orange Vitreous } Alkaline o timony.
39		Zinc.	— —	—	—	—	Oxide of zinc. Sublimated oxide of zinc.	*Calx of zinc.* *Flowers of zink, pompholix,* &c.	Sulphurated zinc.
40		Iron.	— —	—	—	—	Black Red } oxide of iron.	*Martial ethiops.* *Aſtringent ſaffron of Mars.*	Sulphurated iron.
41		Tin.	— —	—	—	—	White oxide of tin.	*Calx* or *putty of tin.*	Yellow ſulp oxide of
42		Lead.	— —	—	—	—	White Yellow Red Vitreous } oxide of lead.	*Ceruſe,* or *white lead.* *Maſſicot.* *Minium.* *Litharge.*	Sulphurated lead.
43		Copper.	— —	—	—	—	Red Green Blue } oxide of copper.	*Brown calx of copper.* *Green calx of copper,* or *verdegris.* *Mountain blue.*	Ammoniaca copper.
44		Mercury.	— —	—	—	—	Blackiſh Yellow Red } mercurial oxide.	*Æthiops* per ſe. *Turbith mineral.* *Precipitate* per ſe.	Black { fu Red {
45		Silver.	— —	—	—	—	Oxide of ſilver.	*Calx of ſilver.*	Sulphurated ſilver.
46		Platina.	— —	—	—	—	Oxide of platina.	*Calx of platina.*	
47		Gold.	— —	—	—	—	Oxide of gold.	*Calx of gold.*	—
48	EARTHS.	Silex.	*Vitrifiable earth, quartz, &c.*	—	—	—	—	— —	—
49		Alumine.	*Clay,* or *earth of alumn.*	—	—	—	—	— —	—
50		Barytes.	*Terra ponderoſa.*	—	—	—	—	— —	—
51		Lime.	*Calcareous earth.*	—	—	—	—	— —	—
52		Magneſia.	— —	—	—	—	—	— —	—
53	ALKALIES.	Potaſh.	*Vegetable fixed alkali of tartar, &c.*	—	—	—	—	— —	—
54		Soda.	*Mineral alkali, marine alkali, natrum.*	—	—	—	—	— —	—
55		Ammoniac.	*Fluor,* or *cauſtic volatile alkali.*	Ammoniacal gas.	*Alkaline gas.*		—	— —	—

* As the ſubſtances in the lower part of the column cannot be reduced into a gazeous ſtate, and not only they, but ſeveral of thoſe in the upper part : we have there

DENOMINATIONS newly appropriated to ſeveral Subſtances, which are more compound in th

	1	2	3	4	5	6	7	8	9	10
New Names	Mucous matter.	Glutinous matter, *or* gluten.	Sugar.	Starch.	Fixed oil.	Volatile oil.	The aroma, *or* aromatous principle.	Reſin.	Extractive matter.	Extracto-reſinous matter. { in which extract matter p dominat
Ancient Names.	*Mucilage.*	*Glutinous matter.*	*Saccharine matter.*	*Amylaceous matter.*	*Fat oil.*	*Eſſential oil.*	*Spiritous rector.*	*Reſin.*	*Extractive matter.*	

—	—	—	Pyro-lignite of lime. Pyro lignite of zinc, &c.	—	—				
—	—	—	Pyro-mucite of magneſia. Ammoniacal, &c. pyro-mucite.		—	—	—	—	22
—	—	—	Camphorate of ſoda, &c.	—	—	—	—	—	23
—	—	—	Lactate of lime, &c.	—	—	—	—	—	24
—	—	—	Saccho-lactate of iron, &c.	—	—	—	—	—	25
—	—	—	Ammoniacal, &c. formiate.	*Spirit of magnanimity.*		—	—	—	26
—	—	—	Pruſſiate of potaſh, &c. Pruſſiate of iron, &c.	*Phlogiſticated alkali*, or *Pruſſian alkali.* *Pruſſian blue.*		—	—	—	27
—	—	—	Sebate of lime, &c.	—	—	—	—	—	28
—	—	—	Lithiate of ſoda, &c.	—	—	—	—	—	29
—	—	—	Bombiate of iron, &c.	—	—	—	—	—	30
OXIDES WITH VARIOUS BASES *.									
Yellow Red } ſulphurated oxide of arſenic. Arſenical oxide of potaſh.	*Orpiment.* *Realgar.* *Liver of arſenic.*		Arſeniate of potaſh, &c. Arſeniate of copper.	*Macquer's arſenical neutral ſalt.*		Alloy of arſenic and tin.	*Arſenicated tin.*		31
Sulphure of molybdena.	*Molybdena.*		Molybdate.	—	—	Alloy, &c.	—	—	32
—	—	—	Calcarcous tunſtate.	*Swediſh tunſten.*		Alloy, &c.	—	—	33
—	—	—	—	—	—	Alloy of manganeſe and iron.	—	—	34
—	—	—	—	—	—	Alloy of nickel, &c.	—	—	35
Alkaline cobaltic oxides.	*Precipitates of cobalt again diſſolved by alkalies*		—	—	—	Alloy, &c.	—	—	36
Sulphurated oxide of biſmuth.	*Biſmuth precipitated by liver of ſulphur.*		—	—	—	Alloy, &c.	—	—	37
Grey Red Orange Vitreous } Sulphurated oxide of antimony. Alkaline oxide of antimony.	*Grey calx of antimony.* *Kermes mineral.* *Golden ſulphur.* *Glaſs and liver of antimony.* *Rotrou's ſolvent.*		—	—	—	Alloy, &c.	—	—	38
Sulphurated oxide of zinc.	*Precipitate of zinc by liver of ſulphur* or *factitious blende.*		—	—	—	Alloy, &c.	—	—	39
Sulphurated oxide of iron.	—	—	—	—	—	Alloy, &c.	—	—	40
Yellow ſulphurated oxide of tin.	*Aurum muſivum.*		—	—	—	Alloy, &c.	—	—	41
Sulphurated oxide of lead.	—		—	—	—	Alloy, &c.	—	—	42
Ammoniacal oxide of copper.	—		—	—	—	Alloy, &c.	—	—	43
Black Red } ſulphurated oxide of mercury.	*Æthiops mineral.* *Cinnabar.*		—	—	—	Alloy or amalgam of &c.	—		44
Sulphurated oxide of ſilver.	—		—	—	—	Alloy, &c.	—	—	45
—	—	—	—	—	—	Alloy, of platina & gold.	—	—	46
—	—	—	—	—	—	Alloy, &c.	—	—	47
—	—	—	—	—	—	—	—	—	48
—	—	—	—	—	—	—	—	—	49
—	—	—	—	—	—	—	—	—	50
—	—	—	—	—	—	—	—	—	51
—	—	—	—	—	—	—	—	—	52
—	—	—	—	—	—	—	—	—	53
—	—	—	—	—	—	—	—	—	54
—	—	—	—	—	—	—	—	—	55

t : we have therefore changed at this place the title of the column, and ſubſtituted another, which expreſſes the peculiar combinations of the metals.

pound in their Nature, yet enter into new Combinations without being decompoſed.

10	11	12	13	14	15	16	17
racto- ous ter. { in which the extractive matter predominates.	Reſino-extractive matter } in which the reſin predominates.	Feculum.	Alcohol or ſpirit of wine.	Alcohol { of potaſh. of guaiacum. of ſcammoneum. of myrrh, &c.	Nitrous Gallic Muriatic } alcohol.	Sulphuric Muriatic Acetic, &c. } ether.	Alkaline Earthy Acid Metallic } ſoaps. Saponula of turpentine, &c.
		Feculum.	*Spirit of wine.*	*Alkaline tincture.* *Tincture of guaiacum.* ——— *of ſcammonium.* ——— *of myrrh, &c.*	*Dulcified ſpirit of nitre.* *Tincture of nut galls.* *Dulcified marine acid.*	*Æther of Frobenius,* *Marine ether.* *Acetous ether.*	*Alkaline, earthy, &c. ſoaps.* *Combinations of volatile oils with baſes.*

ABLE I.

The Diviſion and Characters of the Eight Claſſes of Anim

ANIMAL

Having an Head.					
With Noſtrils.					
With Ears.					
Two Ventricles in the Heart.			One Ventricle in the Heart.		
Warm Blood.			Blood nearly cold.		
Inſpiring and expiring the Air frequently.			Inſpiring and expiring the Air, at long Intervals.		Admit Air b
Viviparous.		Oviparous.			
With Teats.		Without Teats.			
Order.	2d Order.	3d Order.	4th Order.	5th Order.	6th Ord
DRUPEDS.	CETACEOUS ANIMALS.	BIRDS.	OVIPAROUS QUADRUPEDS.	SERPENTS.	FISHES
Feet, and ry Skin.	Fins, and no Hair.	Feathered.	Four Feet, and no Hair.	Scaly, without Feet or Fins.	Scaly, wi Fins.

of Animals, by DAUBENTON.

L S.

			The moſt Part having no Head.
		Without Noſtrils.	
		Without Ears.	
the Heart.		The Heart variouſly formed, or unknown.	
cold.		A whitiſh Fluid, inſtead o Blood.	
ir,	Admitting the Air by Gills.	Admitting the Air by Spiracula.	No apparent Entrance or Aperture to admit Air.
iparous.			
out Teats.			
	6th Order. FISHES.	7th Order. INSECTS.	8th Order. WORMS.
	Scaly, with Fins.	Having Antennæ.	Having neither Feet no Scales.

TABLE II. *Quadrupeds, divided accordin*

BRITISH 21 AU 84 MUSEUM

				ORDERS.		
UADRUPEDS,	Without teeth	—	— —	I.	— — —	
	With teeth.	With grinders only	— —	II.	— — —	
		Grinders and canine teeth only	—	III.	— — —	
		Inciſive teeth in the lower jaw only —		IV.	— — Ruminant, ung	
				V.	Ruminant, with cloven feet; eight inciſive teeth.	Simple horns
						Branch
						No hor
		Inciſive teeth in both jaws.	Ungulated feet.	VI.	The hoof entire —	
				VII.	The hoof cloven.	
				VIII.	Three ungulated toes on each	
				IX. X.	Four ungulated toes before,	
				XI.	Four ungulated toes on each f	
			Ungulated feet, and two inciſive teeth in each jaw.	XII.	Without canine teeth	Prick
						Wit
					With canine teeth —	
			Four inciſive teeth in each jaw.	XIII.	— — —	
			Four inciſive teeth in the upper, and ſix in the lower jaw.	XIV.	— — —	
			Six inciſive teeth in the upper, and four in the lower jaw.	XV.	— — —	
			Six inciſive teeth in each jaw.	XVI.	The toes ſeparate from each other.	Fou
						Five
						Five fo
						Feet
						Hoo
					The toes joined together by a	
			Six inciſive teeth in the upper, and eight in the lower jaw.	XVII.	— — —	
			Ten inciſive teeth in the upper, and eight in the lower jaw.	XVIII.	— — —	

according to the Syſtem of BRISSON.

SECTIONS.				GENERA.	
	Hairy ſkin			Ant-eater	*Myrmecophaga.*
	Scaly			Manis	*Pholidotus.*
	Hairy ſkin			Sloth	*Tardigradus.*
	Bony covering or ſhell			Armadillo	*Cataphractus.*
	Two long tuſks above, and a trunk			Elephant	*Elephas.*
	Two long tuſks below, and no trunk			Sea Cow	*Odobenus.*
uminant, ungulated ; ſix inciſive teeth				Camel	*Camelus.*
ight	Simple horns.	Turned upwards.	Fore legs longer than hinder legs	Camelopardalis	*Giraffa.*
			The legs of equal length	Goat	*Hircus.*
		Turned back		Sheep	*Aries.*
		Turned ſideways		Ox	*Bos.*
	Branched horns			Stag	*Cervus.*
	No horns			Muſk	*Tragulus.*
				Horſe	*Equus.*
				Hog	*Sus.*
toes on each foot				Rhinoceros	*Rhinoceros.*
toes before, three behind,	Two inciſive teeth in each jaw			River Hog	*Hydrochærus.*
	Ten inciſive teeth in each jaw			Tapir	*Tapirus.*
oes on each foot				River Horſe	*Hippopotamus.*
teeth	Prickles on the body			Porcupine	*Hyſtrix.*
	Without prickles.	Tail flat and ſcaly		Beaver	*Caſtor*
		Short tail	Long ears	Hare	*Lepus.*
			Short ears	Coney	*Cuniculus.*
		Long tail	Flat	Squirrel	*Sciurus.*
			Round	Dormouſe	*Glis.*
		Naked tail		Rat	*Mus.*
h	Without prickles on the body			Shrew Mouſe	*Muſaraneus.*
	With prickles			Hedge Hog	*Erinaceus.*
	Separate toes			Ape	*Simia.*
	Toes joined by a membrane ſo as to form wings			—	*Pteropus.*
	Separate toes			Maki	*Proſimia.*
	The fore toe joined ſo as to form wings			Bat	*Veſpertilio.*
				Seal	*Phoca.*
e from	Four toes on the fore, and five on the hinder feet			Hyæna	*Hyæna.*
	Five toes on the fore, and four on the hinder feet			Dog	*Canis.*
	Five toes on each foot,	Firſt toe remote from the other		Weezel	*Muſtela.*
		Firſt toe near the other		Badger	*Meles.*
	Feet which reſt on the heel in walking			Bear	*Urſus.*
	Hooked claws which may be drawn back and concealed			Cat	*Felis.*
ogether by a membrane				Otter	*Lutra.*
				Mole	*Talpa.*
				Opoſſum	*Philander.*

TABLE III.

The Ornithologic Syſtem of

O R D

IRDS
ARE

Either CLOVEN-FOOTED; that is, they have the toes naked, and apart from each other;

The legs feathered as low as the calcaneum, or bone which ſuſtains the toes.

Four toes all ſeparate from each other, quite to their baſe.

Three toes before, and one behind. — —

I. The beak
dible thi
curved a
trils hal
ſoft men
one genu

II. The beak
It conſiſt

III. The beak
It conſiſt

IV. The beak
It conſiſt

V. The beak f
dible gro
wards th
four gene

VI. The beak f
bles not g
two gene

VII. The beak
bent. It

VIII. The beak
horizonta
bent at t
ing of th
ger than
of two g

IX. The beak
dually
point.
genera.

X. The beak
ſiſts of th

XI. The beak w
ſiſts of on

XII. The beak fi
three ger

Two toes before, and two behind. —

XIII. Conſiſting of

The middle to be united with the exterior for the ſpace of three phalanges, and with the interior for the ſpace of one phalanx; four toes; three before, one behind.

XIV. ——— ſe

n *of* BRISSON.

ORDERS.	SECTIONS.	GENERA.	
The beak ſtrait; the upper mandible thickened, and ſomewhat curved at the point; the noſtrils half-covered with a thick ſoft membrane. It conſiſts of one genus only.	— — — — —	Pigeon.	*Columba.*
The beak conical and curved. It conſiſts of ſix genera.	Sections. 1. The head ornamented with appendices.	Turkey.	*Gallus Pavo.*
		Cock and Hen.	*Gallus.*
		Guinea Hen	*Meleagris.*
	2. No appendices on the head.	Grous	*Lagopus.*
		Partridge	*Perdix.*
		Pheaſant	*Phaſianus.*
The beak ſhort and crooked. It conſiſts of five genera.	1. The baſe of the beak covered with a naked ſkin.	Hawk	*Accipiter.*
		Eagle	*Aquila.*
		Vulture	*Vultur.*
	2. The baſe of the beak covered with feathers turned forwards.	Owl	*Aſio.* *Strix.*
The beak long and conical. It conſiſts of ſix genera.	1. The feathers on the baſe of the beak turned forward, and covering the noſtrils.	Chough	*Coracia.*
		Crow	*Corvus.*
		Magpie	*Pica.*
	2. The feathers at the baſe of the beak turned backward; the noſtrils uncovered.	Roller	*Galgulus.*
		Oriole	*Icterus.*
		Bird of Paradiſe	*Manucodiata.*
The beak ſtrait; the upper mandible grooved on each ſide towards the point. It conſiſts of four genera.	1. The beak convex above.	Butcher Bird	*Lanius.*
		Thruſh	*Turdus.*
		Chatterer.	*Cotinga.*
	2. The beak flattened horizontally towards the baſe, and nearly triangular.	Fly-catcher	*Muſcicapa.*
The beak ſtrait, and the mandibles not grooved. It conſiſts of two genera.	— — — — —	Beef eater	*Buphagus.*
		Starling	*Sturnus.*
The beak ſlender, and rather bent. It conſiſts of two genera.	— — — — —	Hoopoe	*Upupa.*
		Promerops	*Promerops.*
The beak very ſmall, flattened horizontally at its baſe, and bent at the point; the opening of the mouth appears larger than the head. It conſiſts of two genera.	— — — — —	Goat ſucker	*Caprimulgus.*
		Swallow	*Hirundo.*
The beak conical, and gradually diminiſhing to the point. It conſiſts of eight genera.	1. The two mandibles ſtrait.	Tanager	*Tangara.*
		Goldfinch	*Carduelis.*
		Sparrow	*Paſſer.*
		Groſbeak	*Coccothrauſtes.*
		Bunting	*Emberiza.*
		Coly	*Colius.*
		Bullfinch	*Pyrrhula.*
	2. The two mandibles croſſing each other.	Croſsbill	*Loxia.*
The beak awl-ſhaped. It conſiſts of three genera.	1. The noſtrils uncovered.	Lark	*Alauda.*
		Beccafico	*Ficedula.*
	2. The noſtrils covered by the feathers at the baſe of the beak.	Tit-mouſe	*Parus.*
The beak wedge-ſhaped. It conſiſts of one genus only.	— — — — —	Nuthatch	*Sitta.*
The beak filiform. It conſiſts of three genera.	1. The beak curved.	Creeper	*Certhia.*
	2. The beak flattened horizontally, and a little enlarged at the point; the feet very ſhort.	Humming Bird	*Polytmus.* *Melliſuga.*
Conſiſting of nine genera.	1. The tongue very long and vermiform, but not longer than the beak.	Wryneck	*Torquilla.*
		Wood-pecker	*Picus.*
	2. The beak very long, quadrangular, and pointed.	Jacamar	*Galbula.*
	3. The beak ſomewhat curved, convex at its upper part, and flattened laterally.	Barbet	*Bucco.*
		Cuckow	*Cuculus.*
	4. The beak ſhort and crooked.	Curucui	*Trogon.*
		Ani	*Crotophagus.*
		Parrot	*Pſittacus.*
	5. The beak long, and as thick as the head, indented like a ſaw; the point of each mandible turned downwards.	Toucan	*Tucana.*
——— ſeven genera.	1. The beak ſhort, and flattened laterally near the point.	. . . .	*Rupicola.*
		Manakin.	*Manacus.*
	2. The beak conical, and indented like a ſaw; the end of each mandible bent downwards.	Motmot	*Momotus.*
	3. The beak ſtrait, and of a moderate length.	King's-fiſher	*Iſpida.*
		Tody	*Todus.*
	4. The beak curved and ſharp.	Bee eater	*Apiaſter.*
	5. The beak thick, and formed like a ſcyth.	Hornbill	*Hydrocorax.*

IRDS
ARE

- The middle to be united with the exterior for the ſpace of three phalanges, and with the interior for the ſpace of one phalanx; four toes; three before, one behind. XIV.
- The lower part of the legs without feathers.
  - Wings too ſmall for flight. — — — — XV.
  - Wings large enough for flight.
    - Three toes only, all before. — — — XVI.
    - Three toes before, and one behind. — — XVII.
- or WEB-FOOTED; that is, they have the toes furniſhed with membranes.
  - The membranes of the feet divided. Four toes; three before and one behind, which are divided, and have membranous edges. XVIII.
  - The membranes partly divided; the toes joined together near their baſe; the legs placed behind near the anus. XIX.
  - The membranes entire.
    - The legs placed behind near the anus.
      - Three toes before, connected by a membrane; no toes behind. XX.
      - Three toes before, connected by a membrane; one ſeparate toe behind. XXI.
    - The legs placed in the middle of the body, and ſhorter than it.
      - The three anterior toes connected by a membrane.
        - Without a poſterior toe. — XXII.
        - A fourth toe behind, ſeparate from the others.
          - Indented beak. XXIII.
          - Beak not indented. XXIV.
      - The four toes connected by a membrane. — XXV.
    - The legs longer than the body. — — — — XXVI.

		ed like a ſaw; the point of each mandible turned downwards.	Toucan	*Tucana.*
V:	ſeven genera.	1. The beak ſhort, and flattened laterally near the point.	. . . .	*Rupicola.*
			Manakin.	*Manaous.*
		2. The beak conical, and indented like a ſaw; the end of each mandible bent downwards.	Motmot	*Momotus.*
		3. The beak ſtrait, and of a moderate length.	King's-fiſher	*Iſpida.*
			Tody	*Todus.*
		4. The beak curved and ſharp.	Bee eater	*Apiaſter.*
		5. The beak thick, and formed like a ſcyth.	Hornbill	*Hydrocorax.*
V;	four genera.	1. Two toes before, none behind; the beak ſtrait, ſomewhat flattened horizontally, and curved at the point; the upper part of the head bald & ſcaly.	Oſtrich.	*Struthio.*
		2. Three toes before, none behind.	Emu	*Rhea.*
			Caſſowary	*Caſuarius.*
		3. Three toes before, one behind; the beak long and ſtrong; both mandibles hooked at the point.	Dodo	*Raphus.*
:	four genera.	1. The beak conical and curved.	Buſtard	*Otis.*
		2. The beak ſtrait, and thickeſt at the point.	Long-Legs	*Himantopus.*
			Oyſter-catcher	*Oſtralega.*
			Plover	*Pluvialis.*
.	eighteen genera.	1. The beak ſtrait, and thickeſt near the point.	Lapwing	*Vanellus.*
			Jacana	*Jacana.*
		2. The beak a little turned up, and ſomewhat flattened horizontally.	Turnſtone	*Arenaria.*
		3. The beak convex above, and flattened laterally.	Pratincole	*Glareola.*
		4. The beak ſtrait, and flattened laterally.	Rail	*Rallus.*
		5. The beak ſtrait and ſlender.	Sandpiper	*Tringa.*
			Godwit	*Limoſa.*
			Woodcock	*Scolopax.*
		6. The beak curved in an arc downwards.	Curlew	*Numenius.*
		7. The beak ſtrait, flattened horizontally, and dilated at its extremity like a ſpatula.	Spoonbill	*Platea.*
		8. The beak long and thick.	Stork	*Ciconia.*
			Heron	*Ardea.*
			Umbre	*Scopus.*
		9. The beak ſhort and thick, the upper mandible in the form of a ſpoon.	Boat-bill	*Cochlearius.*
		10. The beak ſhort and ſtrait, conical at the point; the head adorned with a crown of feathers.	Crown Bird	*Balearica.*
		11. The beak conical and curved.	Cariama	*Cariama.*
			Screamer	*Anhima.*
		12. The beak conical, flattened at the ſides, and the fore-part of the head without feathers.	Gallinule	*Porphyrio.*
.	three genera.	1. The membranes of the toes ſimple, the beak ſtrait and acute.	Water-Hen	*Gallinula.*
			Phalarope	*Phalaropus.*
		2. The membranes of the toes jagged.	Coot.	*Fulica.*
.	one genus.	— — — — --	Grebe.	*Colymbus.*
.	three genera.	1. The beak ſtrait and acute.	Guillemot.	*Uria.*
		2. The beak flattened at the ſides, with tranſverſe ſtriæ.	Puffin.	*Fratercula.*
			Auk.	*Alca.*
I.	three genera.	1. The beak ſtrait, the extremity of the upper mandible bent.	Pinguin.	*Spheniſcus.*
			. . .	*Catarractes.*
		2. The beak ſtrait and acute.	Diver.	*Mergus.*
I.	one genus.	— — — —	Albatroſs	*Albatrus.*
I.	ſix genera.	1. The beak bent near its point.	Shearwater	*Puffinus.*
			Petrel.	*Procellaria.*
			Arctic Bird	*Stercorarius.*
			Gull	*Larus.*
		2. The beak flattened at the ſides.	Tern	*Sterna.*
			Razorbill	*Rygchopſalia.*
7.	three genera.	1. The beak rather cylindrical; the extremity of the upper mandible bent.	Merganſer	*Merganſer.*
		2. The beak convex on its upper part, and flat beneath.	Gooſe.	*Anſer.*
			Duck	*Anas.*
7.	five genera.	1. The beak acute.	Dartar	*Anhinga.*
			Tropic Bird	*Lepturus.*
		2. The beak hooked at the point.	Booby	*Sula.*
			Cormorant	*Phalacrocorax.*
			Pelican	*Onocrocalus.*
VI.	three genera.	1. The beak indented, curved in the middle, and the inferior mandible largeſt.	Flamingo	*Phænicopterus.*
		2. The beak not indented.	Avoſet	*Avocetta.*
			Courier	*Corrira.*

Table IV. *The Diviſion of Oviparous Quadrupeds, by* Daubenton.

OVIPAROUS QUADRUPEDS.	CLASS I. The body covered with a ſhell. TORTOISES.		Conſiſting of 15 ſpecies.
	CLASS II. The body naked, with a tail. LIZARDS.	Genus I. Lizards which have the body ſomewhat tuberculated, and the tail flat.	Conſiſting of 8 ſpecies.
		Genus II. Lizards which have the tail verticillated.	Conſiſting of 12 ſpecies.
		Genus III. Lizards which have the tail round, ſcaly, and ſhorter than the body.	Conſiſting of 5 ſpecies.
		Genus IV. Lizards which have the tail round, ſcaly, and longer than the body.	Conſiſting of 17 ſpecies.
		Genus V. Lizards which have four	

OVIPAROUS QUADRUPEDS.		the body.	
		Genus V. Lizards which have four toes on the fore-feet, and the body ſmooth.	Conſiſting of 5 ſpecies.
		Genus VI. Winged Lizards.	The Dragon.
	CLASS III. The body naked, without a tail.	Genus I. Toads; the body round, and tuberculated, the legs ſhort.	Conſiſting of 14 ſpecies.
		Genus II. Frogs which have the body long.	Conſiſting of 11 ſpecies.
		Genus III. Frogs which have the toes terminating in a broad flat ſurface.	Conſiſting of 9 ſpecies.

TABLE V. *A Syſtematic Table of Oviparous Quadrupeds, by* M. DE LA CEPEDE.

		DIVISIONS.	
CLASS I. OVIPAROUS QUADRUPEDS, having a tail.	Genus I. TORTOISES. The body covered with a ſhell.	I. The toes are very unequal, and aſſume, towards the extremities, the form of fins.	It conſiſts of 6 ſpecies.
		II. The toes very ſhort, and nearly equal.	It conſiſts of 18 ſpecies.
	Genus II. LIZARDS. The body not covered with a ſhell.	I. The tail flat, and five toes on the fore-feet.	It conſiſts of 11 ſpecies.
		II. The tail round, five toes on each foot, and ſcales riſing on the back in the form of a creſt.	It conſiſts of 5 ſpecies.
		III. The tail round, five toes on the fore-feet, and ſcaly ſtripes running acroſs the belly.	It conſiſts of 7 ſpecies.
		IV. The tail round, and five toes on the fore-feet, but no ſcaly ſtripes under the belly.	It conſiſts of 21 ſpecies.
		V. The under part of the toes covered with ſcales, riſing over one another, like ſlates on the roof of a houſe.	It conſiſts of 3 ſpecies.

	The body not covered with a ſhell.	V. The under part of the toes covered with ſcales, riſing over one another, like ſlates on the roof of a houſe.	It conſiſts of 3 ſpecies.
		VI. Three toes on both the fore and the hinder feet.	It conſiſts of 2 ſpecies.
		VII. Membranes, of the form of wings.	It conſiſts of 1 ſpecies.
		VIII. Three or four toes on the fore-feet, and four or five toes on the hinder-feet.	It conſiſts of 6 ſpecies.
CLASS II. Oviparous Quadrupeds, without a tail.	Genus I. Frogs. The head and body oblong, and either the one or the other angular.	— — — — — — —	It conſiſts of 12 ſpecies.
	Genus II. The body oblong, and balls of viſcid matter under the toes.	— — — — — — —	It conſiſts of 7 ſpecies.
	Genus III. The body bloated and round.	— — — — — — —	It conſiſts of 14 ſpecies.
TWO-FOOTED REPTILES. — — —		I. Two fore-feet.	It conſiſts of 1 ſpecies.
		II. Two hinder-feet.	It conſiſts of 1 ſpecies.

TABLE VI. *The Diviſion of Serpents, by* DAUBE

RPENTS.	Genus I. Rattle-ſnakes; or ſuch as have a Rattle at the extremity of the tail. Crotalus, Linnæi.	It conſ
	Genus II. Serpents which have large ſcales (Scuta) beneath the body and tail; without a Rattle. Boa, Linn.	It conſ
	Genus III. Serpents which have large ſcales (Scuta) beneath the body, and ſmall ſcales (Squamæ) beneath the tail. Coluber, Linn.	It conſ
	Genus IV. Serpents which have ſmall ſcales beneath the body and tail. Anguis, Linn.	It conſ
	Genus V. Serpents which have the body divided into annuli or rings. Amphiſbæna, Linn.	It conſ
	Genus VI. Serpents which have the ſkin naked and ſmooth. Cæcilia, Linn.	It conſ

DAUBENTON.

e	It conſiſts of four ſpecies.
.	It conſiſts of ten ſpecies.
) s	It conſiſts of ninety-ſix ſpecies.
	It conſiſts of thirteen ſpecies.
.	It conſiſts of two ſpecies.
	It conſiſts of two ſpecies.

TABLE VII. *The Ichthyologic Syſt*

FISHES
HAVE

- EITHER The gills perfect,
  - Claſs I. ACANTHOPTERYGII. The fins ſupported by ſmall bones.
    - Order
      The ventr
    - Order I
      The belly-fins
      neck.
    - Order I
      The ventral
      the breaſt.
    - Order IV
      The ventral
      the abdom
  - Claſs II. MALACOPTERYGII. The fins ſoft, and without bones.
    - Orde
    - Order
    - Order I
    - Order IV
- OR The gills imperfect.
  - Claſs III. BRONCHIOSTEGI.
    - Orde
    - Order
    - Order
    - Order IV

logic *Syſtem of* GOUAN.

Order I. Apodes. The ventral fins wanting.	1.	———	*Trichiuru*
	2.	Sword-fiſh	*Xiphias*
	3.	———	*Ophidium*
Order II. Jugulares. The belly-fins placed beneath the neck.	1.	Weveer	*Trachinus*
	2.	———	*Uranoſque*
	3.	Dragonet	*Callyonymus.*
	4.	Blenny	*Blennius.*
Order III. Thoracici The ventral fins placed beneath the breaſt.	1.	Goby	*Gobius*
	2.	———	*Cepola.*
	3.	Dolphin	*Coryphæna.*
	4.	Mackrel	*Scomber.*
	5.	Wraſſe	*Labrus.*
	6.	Gilthead	*Sparus.*
	7.	———	*Chætodon.*
	8.	———	*Sciœna.*
	9.	Perch	*Perca.*
	10.	Father Laſher	*Scorpæna.*
	11.	Surmullet	*Mullus.*
	12.	Gurnard	*Trigla.*
	13.	Bull-head	*Cottus.*
	14.	Doree	*Zeus.*
	15.	———	*Trachipterus.*
	16.	Stickle-back	*Gaſteroſteus.*
Order IV. Abdominales. The ventral fins placed beneath the abdomen.	1.	Catfiſh	*Silurus.*
	2.	Mullet	*Mugil.*
	3.	———	*Polynemus.*
	4.	———	*Theutys.*
	5.	———	*Elops.*
Order I. Apodes.	1.	Eel	*Muræna.*
	2.	Gymnotus	*Gymnotus.*
	3.	Wolf-fiſh	*Anarhichas.*
	4.	———	*Stromateus.*
	5.	Launce	*Ammodytes.*
Order II. Jugulares.	1.	———	*Lepadogaſter.*
	2.	Cod	*Gadus.*
Order III. Thoracici.	1.	Flounder	*Pleuronectes.*
	2.	Sucking-fiſh	*Echeneis.*
	3.	———	*Lepidopus.*
Order IV. Abdominales.	1.	———	*Loricaria.*
	2.	Atherine	*Atherina.*
	3.	Salmon	*Salmo.*
	4.	———	*Fiſtularia.*
	5.	Pike	*Eſox.*
	6.	Argentine	*Argentina.*
	7.	Herring	*Clupea.*
	8.	Flying-fiſh	*Exocœtus.*
	9.	Carp	*Cyprinus.*
	10.	Loche	*Cobitis.*
	11.	———	*Amia.*
	12.	———	*Mormyrus.*
Order I. Apodes.	1.	Pipe-fiſh	*Syngnathus.*
	2.	Baliſtes.	*Baliſtes.*
	3.	———	*Oſtracion.*
	4.	———	*Tetraodon.*
	5.	Sun-fiſh	*Diodon.*
Order II. Jugulares.	1.	Angler	*Lophius.*
Order III. Thoracici.	1.	Lump-fiſh	*Cyclopterus.*
Order IV. Abdominales.	1.	———	*Centriſcus.*
	2.	———	*Pegaſus.*

TABLE VIII. *The Entomologic Method of G*

SECTIONS.	ARTICLES.	ORDERS.
SECT. I. Coleoptera, or Inſects with cruſtaceous ſhells over their wings. .	I. . . . . Either the ſhell is hard, and covers the whole abdomen; and their feet have . . .	I. . . . . Either five articulations to all the feet, ſuch as th
		II. . . . . Or, four articulations to all the feet, ſuch as th
		III. . . . . Or, three articulations to all the feet, ſuch as . .
		IV. . . . . Or, five articulations in the two firſt pair of feet and four only in the hinder pair, ſuch as . .
	II. . . . . Or the ſhell is hard, and covers only part of the abdomen; and their feet have.	I. . . . . Either five articulations to all the feet, . . .
		II. . . . . Or four articulations to all the feet, ...
		III. . . . . Or three articulations to all the feet, . . .
		IV. . . . . Or five articulations to the two firſt pair of feet, and four to the latter,
	III. . . . . The ſhell is ſoft, and their feet have	I. . . . . Either five articulations to the two firſt pair of feet, and four only to the latter, ...
		II. . . . . Or two articulations to all the feet. . . . . .
		III. . . . . Or three articulations to all the feet, . . .
		IV. . . . . Or four articulations to all the feet, . . .
		V. . . . . Or five articulations to all the feet, ...

d *of* GEOFFROY.

	GENERA.
	Platycerus. *Ptilinus.* *Scarabæus.* *Copris.* *Attelabus.*
t, ſuch as the	*Dermeſtes.* *Byrrhus.* *Anthrenus.* *Ciſtela.* *Peltis.* *Cucujus.* *Elater.* *Bupreſtis.* *Bruchus.*
	Lampyris. *Cicindela.* *Omalyſus.* *Hydrophylus.* *Dyticus.* *Gyrinus.*
, ſuch as the	*Melolontha.* *Prionus.* *Cerambix.* *Leptura.* *Stenocorus.* *Luperus.* *Cryptocephalus.* *Crioceris.* *Altica.* *Galeruca.* *Chryſomela.* *Milabris.* *Rhinomacer.* *Curculio.* *Boſtrichus.* *Clerus.* *Anthribus.* *Scolytus.* *Caſſida.* *Anaſpis.*
ſuch as . . .	*Coccinella.* *Tritoma.*
t pair of feet, uch as . . .	*Diaperis.* *Pyrochroa.* *Cantharis.* *Tenebrio.* *Mordella.* *Notoxus.* *Cerocoma.*
t, ...	*Staphylinus.*
. . . . . .	*Necydalis.*
. . . . .	*Forficula.*
pair of feet,	*Meloe.*
t pair of feet, ...	*Blatta.*
. . . . . .	*Trips.*
. . .	*Gryllus.* *Acrydium.*
. . .	*Locuſta.*
. . . . .	*Mantes.*

SECTIONS.	ARTICLES.	GENERA.
II. . . . Hemyptera, or inſects whoſe upper wings are half cruſtaceous, half membranaceous, ...		*Cicada.* *Cimex.* *Naucoris.* *Notonecta.* *Corixa.* *Hepa.* *Pſylla.* *Aphis.* *Chermes.* *Coccus.*
III. . . . . Inſects with four farinaceous wings, ...		*Papilio.* *Sphinx.* *Pterephorus.* *Phalæna.* *Tinæ.*
IV. . . . Inſects with four naked membranaceous wings.	I. . . Three articulations to the feet. .	*Libellula.* *Perla.*
	II. . . Four articulations to the feet. . .	*Ruphidia.*
	III. . . Five articulations to the feet. . .	*Ephemera.* *Phryganea.* *Hemerobius.* *Formicaleo.* *Panorpa.* *Crabro.* *Urocerus.* *Tenthredo.* *Cynips.* *Diplolepis.* *Eulophus.* *Ichneumon.* *Veſpa.* *Apis.* *Formica.*
V. . . . . Inſects with two wings, ...		*Oeſtrus.* *Tabanus.* *Aſilus.* *Stratiomys.* *Muſca.* *Stomoxys.* *Volucella.* *Nemotelus* *Scatopſe.* *Hyppoboſca.* *Tipula.* *Bibio.* *Culex.*
VI. . . . . Inſects without wings, ...		*Pediculus.* *Podura.* *Forbicina.* *Pulex.* *Chelifer.* *Acarus.* *Phalangium.* *Aranea.* *Monoculus.* *Binoculus.* *Cancer.* *Oniſcus.* *Aſellus.* *Scolopendra.* *Iulus.*

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CONCERNING THE

TWO TABLES OF SYNONYMOUS NAMES.

TO our general table of the ſyſtematic Nomenclature, exhibiting the whole of our ſyſtem, we ave thought proper to add a liſt of ſynonyma, conining all the words neceſſary in denominating chemical eparations. This liſt of ſynonyma is given in the rm of two vocabularies. In the firſt of theſe, are the d names, diſpoſed in alphabetical order; and oppoſite them, the correſpondent, new, or newly adopted ames. This vocabulary not only ſhews the names hich we have given to the different chemical compounds; but perſons not very well acquainted with the eparations in general, the old names of which do not all explain their nature, will find, in the new ſynoymous words, a ſort of definition of the ſubſtances to hich they are affixed, ſufficiently plain and diſtinct, to able them to underſtand their natures.

In the ſecond vocabulary, the order of the new and e old names is directly contrary to that of the firſt; d we hope it will be found no leſs uſeful.

In it, the new names appear in alphabetical order, d oppoſite to them, are exhibited the correſponding

old names. In this, our object was, to give a complet
liſt of ſynonymous terms, in order that ſtudents migh
not, in this ſcience, be under the ſame difficulties as in
ſome others, particularly in Mineralogy and Botany, in
which the vaſt variety of different names given to th
ſame thing, has produced a degree of confuſion and obſcurity, which the labours of ſome of the moſt indefatigable men have not been ſufficient to remove.

In this new vocabulary, we ſhew that the ſame ſubſtance has frequently received eight, ten, or twelve different names; that moſt of theſe names bear no relatio
to the things to which they are affixed;—which indee
could not but happen in a ſcience in which the firſ
writers ſought to conceal every thing under a veil o
myſtery; and in the hiſtory of which we cannot trac
the ſeveral periods at which thoſe who have cultivate
it, have attained an accurate knowledge of the differen
compounds. But, to avoid tedioufneſs and obſcurity,
we have taken care not to exhibit here, the names anciently given to different ſubſtances by the alchemiſts,
which, as they were founded on abſurd or chimerica
ideas, have happily been forgotten ſince chemiſtry ha
begun to make equal progreſs with Natural Philoſophy.

Each of theſe tables of ſynonyma, therefore, has it
uſe. The firſt may be uſed as a dictionary in readin
books on chemiſtry, that have been publiſhed befor
this period, as it gives the new name correſponding t
every old name which can occur in ſuch works. In thi
as well as in the following, we have given only th
names of ſimpler compound bodies, and of chemical pre
parations. The names of the operations we have no
given, as we have made no change upon them. Th

ſecon

econd liſt of ſynonyma contains more words than the irſt; for in it, there are a good many compounds, the knowledge of which we owe to late experiments, and hich, till within theſe few years, had no names. It ay therefore be conſidered as being in ſome degree an nventory of the chemical knowledge which we at preent poſſeſs.

In both theſe liſts, there are ſome ſynonymous words mong the new names. We retain them, becauſe ſome f them are very generally uſed, and becauſe ſome choice f expreſſions with different terminations is neceſſary o give variety to diſcourſe, and to prevent a diſguſting onotony. Thus, for inſtance, the word expreſſive of he baſe of neutral ſalts, may be either a ſubſtantive or n adjective, at the pleaſure of the writer. In books on hemiſtry, there may be ſome words found that do not ppear in our vocabularies; but the nature of the compounds to which they have been applied, is not yet ell known; and thoſe who conſider to what ſtrict laws e have here ſubjected ourſelves, will readily be ſenſible, hat it would have been impoſſible for us to give names o combinations but imperfectly known.

We have added ſome definitions to ſeveral general or articular names, either when we have been doubtful of he nature of the compounds to which they belong, or n ſpeaking of bodies but lately diſcovered. The ſecond able, which exhibits the new names in alphabetical orer, with the correſponding old names, gives at the ame time a Latin tranſlation of the new names: In makg out this tranſlation, we have ſtill adhered to the ſame ules. Uniformity of termination, and the laws of deivation, are the two principles by which we have been uniformly directed. Our Nomenclature would have be imperfect, if we had neglected to offer to philoſoph of all nations an uniform mode of expreſſing themſelv which might make them generally underſtood. As t ſcience improves, ſuch new names as ſhall become n ceſſary may be added upon the ſame plan.

COMPARATIVE VIEW

OF

NCIENT and MODERN NAMES

OF

CHEMICAL SUBSTANCES,

IN ALPHABETICAL ORDER.

Old Names.	*New or adopted Names.*
	A
CETATED Ammoniac.	Acetite, ammoniacal.
	Acetite of ammoniac.
tated lime.	Acetite, calcareous.
	Acetite of lime.
tated clay.	Acetite, aluminous.
	Acetite of alumine.
tated copper.	Acetite of copper.
tated magneſia.	Acetite, magneſian.
	Acetite of magneſia.
tated lead.	Acetite of lead.
tated ſoda.	Acetite of ſoda.
tated potaſh.	Acetite of potaſh.
tated zinc.	Acetite of zinc.
tated iron.	Acetite of iron.
tated mercury.	Acetite of mercury.
	Acetite, mercurial.

Old Names.	A	New Names.
Acid, acetous.		Acid, acetous.
Acid, aerial.		Acid, carbonic.
Acid, arſenical.		Acid, arſenic.
Acid of benzoin.		Acid, benzoic.
Acid of borax.		Acid, boracic.
Acid, carbonaceous.		Acid, carbonic.
Acid of citrons.		Acid, citric.
Acid, cretaceous.		Acid, carbonic.
Acid of ants.		Acid, formic.
Acid of apples.		Acid, malic.
Acid, benzonic.		Acid, benzoic.
Acid of ſalt.		Acid, muriatic.
Acid of ſulphur.		Acid, ſulphuric.
Acid of amber.		Acid, ſuccinic.
Acid of ſugar.		Acid, oxalic.
Acid of tallow.		Acid, ſebacic.
Acid of vinegar.		Acid, acetous.
Acid of Wolfram, according to Meſſrs D'Elhuyar.		Acid, tunſtic.
Acid, fluoric.		Acid, fluoric.
Acid, formicine.		Acid, formic.
Acid, galactic.		Acid, lactic.
Acid, gallic.		Acid, gallic.
Acid, lignic.		Acid, pyro-ligneous.
Acid, lithiaſic.		Acid, lithic.
Acid, maluſian.		Acid, malic.
Acid, marine.		Acid, muriatic.
Acid, dephlogiſticated marine.		Acid, oxigenated muriatic.
Acid, mephitic.		Acid, carbonic.
Acid, molybdic.		Acid, molybdic
Acid, white nitrous.		Acid, nitric.
Acid, nitrous, without gas.		Acid, nitric.
Acid, dephlogiſticated nitrous.		Acid, nitric.
Acid, phlogiſticated nitrous.		Acid, nitrous.
Acid, oxaline.		Acid, oxalic.
Acidum perlatum.		Superſaturated phoſphate of ſo
Acid, dephlogiſticated phoſphoric.		Acid, phoſphoric.
Acid, phlogiſticated phoſphoric.		Acid, phoſphorous.
Acid, ſaccharine.		Acid, oxalic.
Acid, ſacchalactic.		Acid, ſaccho-lactic.
Acid, ſebaceous.		Acid, ſebacic.
Acid, ſedative.		Acid, boracic.
Acid, ſparry.		Acid, fluoric.

A

Old Names.	New Names.
Acid, ſulphureous.	Acid, ſulphureous.
Acid, ſyrupous.	Acid, pyro mucous.
Acid, tartareous.	Acid, tartareous.
Acid, tungſtic.	Acid, tunſtic.
Acid, vitriolic.	Acid, ſulphuric.
Acid, phlogiſticated vitriolic.	Acid, ſulphureous.
Acidum pingue.	Imaginary principle of Meyer.
Affinities.	Chemical affinities or attractions.
Aggregation.	Aggregation.
Aggregates.	Aggregates.
Air, vitriolic acid.	Sulphureous acid gas.
Air, alkaline.	Ammoniacal gas.
Air, dephlogiſticated.	Oxigenous gas, *or* vital air.
Air, atmoſpheric.	Atmoſpheric air.
Air of fire, Scheele's.	Oxigenous gas.
Air, factitious.	Carbonic acid gas.
Air, fixed.	Carbonic acid gas.
Air, impure.	Azotic gas.
Air, inflammable.	Hydrogenous gas.
Air of ſulphur, ſtinking.	Sulphurated hydrogenous gas.
Air, putrid.	
Air of Hales, ſolid.	Carbonic acid gas.
Air, vitiated.	Gas azote.
Air, vital.	Oxigenous gas.
Alkaheſt.	Univerſal ſolvent, the exiſtence of which was ſuppoſed by the Alchemiſts.
Alkaheſt of Reſpour.	Potaſh mixed with oxide of zinc.
Alkaheſt of Van Helmont.	Carbonate of potaſh.
Alkalis, in general.	Alkalis.
Alkali of tartar, fixed, not cauſtic.	Carbonate of potaſh.
Alkalis, cauſtic.	Alkalis.
Alkalis, efferveſcent.	Alkaline carbonates.
Alkali of tartar, fixed, cauſtic.	Potaſh.
Alkali, vegetable fixed.	Carbonate of potaſh.
Alkali, cauſtic marine.	Soda.
Alkali, marine, not cauſtic.	Carbonate of ſoda.
Alkali, aerated mineral	Carbonate of ſoda.
Alkali, cauſtic mineral.	Soda.
Alkali, efferveſcent mineral.	Carbonate of ſoda.
Alkali, phlogiſticated.	Ferruginous pruſſiate of potaſh, not ſaturated.
Alkali, Pruſſian.	Ferruginous pruſſiate of potaſh.
Alkali, aerated vegetable.	Carbonate of potaſh.

A

Old Names.	New Names.
Alkali, cauſtic vegetable.	Potaſh.
Alkali, cauſtic volatile.	Ammoniac.
Alkali, concrete volatile.	Ammoniacal carbonate.
Alkali, effervescent volatile.	Ammoniacal carbonate.
Alkali, fluor volatile.	Ammoniac.
Alkali, urinous.	Ammoniac.
Alloy of Metals.	Alloy.
Alum.	Sulphate of alumine. Aluminous ſulphate.
Alum, marine.	Muriate of alumine. Aluminous muriate.
Alum, nitrous.	Nitrate of alumine. Aluminous nitrate.
Amalgam of ſilver.	Amalgam of ſilver.
Amalgam of biſmuth.	Amalgam of biſmuth.
Amalgam of copper.	Amalgam of copper.
Amalgam of tin.	Amalgam of tin.
Amalgam of gold.	Amalgam of gold.
Amalgam of lead.	Amalgam of lead.
Amalgam of zinc.	Amalgam of zinc.
Amber yellow.	Amber.
Ammoniac, arſenical.	Ammoniacal arſeniate. Arſeniate of ammoniac.
Ammoniac, cretaceous.	Ammoniacal carbonate. Carbonate of ammoniac.
Ammoniac, nitrous.	Ammoniacal nitrate. Nitrate of ammoniac.
Ammoniac, phoſphoric.	Ammoniacal phoſphate. Phoſphate of ammoniac.
Ammoniac, ſparry.	Ammoniacal fluate. Fluate of ammoniac.
Ammoniac, tartareous.	Ammoniacal tartarite. Tartarite of ammoniac.
Ammoniac, vitriolic.	Ammoniac ſulphate. Sulphate of ammoniac.
Antimony, ore of.	Native ſulphure of antimony.
Antimony, crude.	Sulphure of antimony.
Antimony, diaphoretic.	White oxide of antimony by nitre.
Aqua ſtygia.	Nitro-muriatic acid by ammoniacal muriate.
Aquila alba.	Mild ſublimated mercurial muriate.
Arcanum duplicatum.	Sulphate of potaſh.
Arſenic, regulus of.	Arſenic.

Old Names.	New Names.
A	
Arſenic, white calx of.	Oxide of arſenic.
Arſenic, red	Red ſulphurated oxide of arſenic.
Arſeniate of potaſh.	Arſeniate of potaſh.
Attractions, elective.	Elective attractions.
Azure of cobalt, or of four fires.	Vitreous oxide of cobalt with ſiliceous earth.
B	
Barotes.	Barytes.
Barotes, effervescent.	Carbonate of barytes.
Baſe of vital air.	Oxygene.
Baſe of marine ſalt.	Soda.
Balſams of Bucquet. See the new Nomenclature.	Balſams.
Balſam of ſulphur.	Sulphure of volatile oil.
Benzoin.	Benzoin.
Benzones.	Benzoates.
Butter of antimony.	Sublimated muriate of antimony.
Butter of arſenic.	Sublimated muriate of arſenic.
Butter of biſmuth.	Sublimated muriate of biſmuth.
Butter of tin.	Sublimated muriate of tin.
Baume's ſolid butter of tin.	Concrete muriate of tin.
Butter of zinc.	Sublimated muriate of zinc.
Bezoar mineral.	Oxide of antimony.
Biſmuth.	Biſmuth.
Bitumens.	Bitumens.
Blende, or *falſe galena.*	Sulphure of zinc.
Blue, Berlin.	Pruſſiate of iron.
Blue, Pruſſian.	Pruſſiate of iron.
Borax, ammoniacal.	Ammoniacal borate.
Borax, argillaceous.	Aluminous borate. Borate of alumine.
Borax, crude.	Borate of ſoda, *or* borate ſuperſaturated with ſoda.
Borax, calcareous.	Calcareous borate. Borate of lime.
Borax of antimony.	Borate of antimony.
Borax of cobalt.	Borate of cobalt.
Borax of copper.	Borate of copper.
Borax of zinc.	Borate of zinc.
Borax, magneſian.	Magneſian borate. Borate of magneſia.

Old Names.	C	New Names.
Borax, martial.		Borate of iron.
Borax, mercurial.		Borate of mercury.
Borax, ponderous or *barotic.*		Barytic borate. Borate of barytes.
Borax, vegetable.		Borate of potaſh.
Braſs, bronze.		Alloy of copper and tin, braſs, *or* bronze.

C

Old Names.	New Names.
Calculus, urinary.	Lithic acid.
Cameleon, mineral.	Oxide of manganeſe and potaſh.
Camphor.	Camphor.
Camphorites, (ſalts.)	Camphorates.
Cauſticum.	Imaginary principle of Meyer.
Ceruſe.	White oxide of lead by acetous acid, *mixed with chalk.*
Ceruſe of antimony.	White oxide of antimony by precipitation.
Coal, pure.	Carbone.
Calx of antimony, vitrified.	Vitreous oxide of antimony.
Calces, metallic.	Metallic oxides.
Cinnabar.	Red ſulphurated oxide of mercury
Citrates, (ſalts.)	Citrates.
Cobalt, or *cobolt.*	Cobalt.
Colcothar.	Red oxide of iron by ſulphuric acid
Copperas, white.	Sulphate of zinc.
Copperas, green.	Sulphate of iron.
Copperas, blue.	Sulphate of copper.
Chalk, ammoniacal.	Ammoniacal carbonate.
Chalk, barotic.	Barytic carbonate.
Chalk of lead.	Carbonate of lead.
Chalk of ſoda.	Carbonate of ſoda.
Chalk of zinc.	Carbonate of zinc.
Chalk, magneſian.	Magneſian carbonate. Carbonate of magneſia.
Chalk, martial.	Carbonate of iron.
Chalk, or *calcareous ſpar.*	Calcareous carbonate. Carbonate of lime.
Clay.	Argilla, mixture of alumine and ſilex.
Clay, pure.	Alumine *or* alumines.
Clay, cretaceous.	Aluminous carbonate. Carbonate of alumine.

D

Old Names.	*New Names.*
Clay, ſparry.	Aluminous fluate. Fluate of alumine.
Cream of lime.	Calcareous carbonate.
Cream or *cryſtals of tartar.*	Acidulous tartarite of potaſh.
Cryſtal mineral.	Nitrite of potaſh, mixed with ſulphate of potaſh.
Cryſtals of ſoda.	Cryſtalliſed carbonate of potaſh.
Cryſtals of the moon.	Cryſtalliſed nitrate of ſilver.
Cryſtals of Venus.	Cryſtalliſed acetite of copper.
Crocus metallorum.	Semi-vitreous ſulphurate oxide of antimony.
Copper.	Copper.
Copper, yellow.	Alloy of copper and zinc, *or* latten.
	D
Diamond.	Diamond.
	E
Emetic.	Antimonial tartarite of potaſh.
Empyreal air.	Oxigenous gas.
Eſſences.	Volatile oils.
Ether, acetous.	Acetic æther.
Ether, marine.	Muriatic æther.
Ether, nitrous.	Nitric æther.
Ether, vitriolic.	Sulphuric æther.
Ethiops, martial.	Black oxide of iron.
Ethiops, mineral.	Black ſulphurated oxide of mercury.
Ethiops per ſe.	Blackiſh mercurial oxide.
Extract.	Extractive principle.
	F
Feculum of plants.	Feculum.
Flowers, ammoniacal of copper.	Sublimated ammoniacal muriate of copper.
Flowers, martial ammoniacal.	Sublimated ammoniacal muriate of iron.

G

Old Names.	*New Names.*
Flowers, ſilver of regulus of antimony.	Sublimated oxide of antimony.
Flowers of arſenic.	Sublimated oxide of arſenic.
Flowers of benzoin.	Sublimated benzoic acid.
Flowers of biſmuth.	Sublimated oxide of biſmuth.
Flowers of tin.	Sublimated oxide of tin.
Flowers, metallic.	Sublimated metallic oxides.
Flowers of ſulphur.	Sublimated ſulphur.
Flowers of zinc.	Sublimated oxide of zinc.
Fluids, aëriform.	Gaſes.
Fluids, Elaſtic.	Gaſes.
Fluor, ammoniacal.	Ammoniacal fluate. Fluate of ammoniac.
Fluor, argillaceous.	Aluminous fluate. Fluate of alumine.
Fluor of potaſh.	Fluate of potaſh.
Fluor of ſoda.	Fluate of ſoda.
Fluor, magneſian.	Magneſian fluate. Fluate of magneſia.
Fluor, heavy.	Barytic fluate. Fluate of barytes.
Formiates, (ſalts.)	Formiates.

G

Galactes, (ſalts.)	Lactates.
Gas, acetous acid.	Acetous acid gas.
Gas, cretaceous acid.	Carbonic acid gas.
Gas, marine acid.	Muriatic acid gas.
Gas, aërated muriatic acid.	Oxigenated muriatic acid gas.
Gas, nitrous acid.	Nitrous acid gas.
Gas, ſparry acid.	Fluoric acid gas.
Gas, ſulphureous acid.	Sulphureous acid gas.
Gas, alkaline.	Ammoniacal acid gas.
Gas, hepatic.	Sulphurated hydrogenous gas.
Gas, inflammable.	Hydrogenous gas.
Gas, carbonaceous inflammable.	Carbonated hydrogenous gas.
Gas, inflammable, of marſhes.	Hydrogenous gas of marſhes, (a mixture of carbonated hydrogenous gas with azotic gas.)
Gas, mephitic.	Carbonic acid gas.
Gas, phlogiſticated.	Gas azote.
Gas, nitrous.	Nitrous gas.

Old Names.	H	New Names.
Gas, phoſphoric, of M. Gengembre.		Phoſphorated hydrogenous gas.
Gas, Pruſſian.		Pruſſic acid gas.
Gazeous waters.		Waters impregnated with carbonic acid.
Gilla vitrioli.		Sulphate of zinc.
Gluten of wheat.		Gluten, or glutinous principle.
Gold.		Gold.
Gold, fulminating.		Ammoniacal oxide of gold.
	H	
Hepars.		Sulphures.
Heat, latent.		Caloric.
	I	
Ink, ſympathetic, by cobalt.		Muriate of cobalt.
Iron, or *mars.*		Iron.
Iron, aërated.		Carbonate of iron.
Iron of water.		Phoſphate of iron.
Jupiter.		Tin.
	K	
Kermes, mineral.		Red ſulphurated oxide of antimony.
	L	
Latten.		Alloy of copper and zinc, *or* latten.
Lapis cauſticus.		Concrete potaſh *or* ſoda.
Limeſtone.		Carbonate of lime.
Lixivium of ſoapmakers.		Solution of ſoda.
Lignites, (ſalts.)		Pyro lignites.
Lilium of Paracelſus.		Alcohol of potaſh.
Liquor of flints.		Siliceous potaſh in liquor.
Liquor, Boyle's fuming.		Ammoniacal ſulphure. Sulphure of ammoniac.
Liquor, fuming, of Libavius.		Fuming muriate of tin.

Old Names.	New Names.
	L
Litharge.	Semi-vitreous oxide of lead, *or* litharge.
Liquor ſaturated with the colouring part of Pruſſian blue.	Pruſſiate of potaſh.
Light.	Light.
Luna.	Silver.
Luna, corneous.	Muriate of ſilver.
Liver of antimony.	Sulphurated oxide of antimony.
Liver of arſenic.	Arſenical oxide of potaſh.
Liver, volatile alkaline of ſulphur.	Ammoniacal ſulphure. Sulphure of ammoniac.
Liver, antimoniated, of ſulphur.	Antimoniated alkaline ſulphure.
Liver, barotic, of ſulphur.	Barytic ſulphure. Sulphure of barytes.
Liver, calcareous, of ſulphur.	Calcareous ſulphure. Sulphure of lime.
Liver, magneſian, of ſulphur.	Sulphure of magneſia. Magneſian ſulphure.
Livers of ſulphur.	Alkaline ſulphures.
Livers of ſulphur, earthy.	Earthy ſulphures.
Lead, or *ſaturn.*	Lead.
Lead, corneous.	Muriate of lead.
Lead, ſpathoſe.	Carbonate of lead.
	M
Magiſtery of biſmuth.	Oxide of biſmuth by nitric acid.
Magiſtery of ſulphur.	Precipitated ſulphur.
Magiſtery of lead.	Precipitated oxide of lead.
Magneſia, white.	Carbonate of magneſia.
Magneſia of Bergman, aërated.	Carbonate of magneſia.
Magneſia, cauſtic.	Magneſia.
Magneſia, cretaceous.	Carbonate of magneſia.
Magneſia, efferveſcent.	Carbonate of magneſia.
Magneſia, fluorated.	Fluate of magneſia.
Magneſia, black.	Black oxide of manganeſe.
Magneſia, ſparry.	Fluate of magneſia.
Maluſites, (ſalts.)	Malates of potaſh, ſoda, &c.
Maſſicot.	Yellow oxide of lead.
Matter of heat.	Caloric.
Matter of fire.	*This word has been uſed to ſignify* light, caloric, *and* phlogiſton.

Old Names.	M	*New Names.*
Materia perlata of Kerkringius.		White oxide of antimony by precipitation.
Mephite, ammoniacal.		Ammoniacal carbonate. Carbonate of ammoniac.
Mephite, barotic.		Barytic carbonate. Carbonate of barytes.
Mephite, calcareous.		Calcareous carbonate. Carbonate of lime.
Milk of lime.		Lime diluted in water.
Mephite of magneſia.		Magneſian carbonate. Carbonate of magneſia.
Mephite of lead		Carbonate of lead.
Mephite of zinc.		Carbonate of zinc.
Mephite, martial.		Carbonate of iron.
Matter, colouring, of Pruſſian blue.		Pruſſic acid.
Mercury.		Mercury.
Mercury of metals.		Imaginary principle of Beccher.
Mercury, mild.		Mild mercurial muriate.
Mercury, white precipitated		Mercurial muriate by precipitation.
Minium.		Red oxide of lead, *or* minium.
Mofetes, atmoſpheric.		Azotic gas.
Molybdes, (ſalts)		Molybdates.
Molybde, ammoniacal.		Ammoniacal molybdate. Molybdate of ammoniac.
Molybde, barotic.		Barytic molybdate. Molybdate of barytes.
Molybde of potaſh.		Molybdate of potaſh.
Molybde of ſoda.		Molybdate of ſoda.
Molybdena.		Molybdena.
Mucilage.		Mucilage.
Muriates, (ſalts)		Muriates.
Muriate of antimony		Muriate of antimony.
Muriate of ſilver.		Muriate of ſilver.
Muriate of biſmuth.		Muriate of biſmuth.
Muriate of cobalt.		Muriate of cobalt.
Muriate of copper.		Muriate of copper,
Muriate of tin.		Muriate of tin.
Muriate of iron.		Muriate of iron.
Muriate of mangancſe.		Muriate of manganeſe.
Muriate of lead.		Muriate of lead.
Muriate of zinc.		Muriate of zinc.
Muriate or *regaline ſalt of platina.*		Nitro muriate of platina.

Old Names.	M	New Names.
Muriate or regaline ſalt of gold.		Muriate of gold.
Muriate, corroſive mercurial.		Corroſive mercurial muriate.
	N	
Natrum, or *natron.*		Carbonate of ſoda.
Nitre.		Nitrate of potaſh, *or* nitre.
Nitre, ammoniacal.		Ammoniacal nitrate.
Nitre, argillaceous.		Nitrate of alumine.
Nitre, calcareous.		Calcareous nitrate. Nitrate of lime.
Nitre, cubic.		Nitrate of ſoda.
Nitre of ſilver.		Nitrate of ſilver.
Nitre of arſenic.		Nitrate of arſenic.
Nitre of biſmuth.		Nitrate of biſmuth.
Nitre of cobalt.		Nitrate of cobalt.
Nitre of copper.		Nitrate of copper.
Nitre of tin.		Nitrate of tin.
Nitre of iron.		Nitrate of iron.
Nitre of magneſia.		Magneſian nitrate. Nitrate of magneſia.
Nitre of manganeſe.		Nitrate of manganeſe.
Nitre of nickel.		Nitrate of nickel.
Nitre of lead.		Nitrate of lead.
Nitre of terra ponderoſa.		Barytic nitrate. Nitrate of barytes.
Nitre of zinc.		Nitrate of zinc.
Nitre, fixed, by itſelf.		Carbonate of potaſh.
Nitre, lunar.		Nitrate of ſilver.
Nitre, mercurial.		Nitrate of mercury.
Nitre, priſmatic.		Nitrate of potaſh.
Nitre, quadrangular.		Nitrate of ſoda.
Nitre, rhomboidal.		Nitrate of ſoda.
Nitre, ſaturnine.		Nitrate of lead.
	O	
Ochre.		Yellow oxide of iron.
Oils, animal.		Volatile animal oil.

Old Names.	New Names.
	O
Oil of lime.	Calcareous muriate.
Oil of tartar per deliquium.	Potaſh, mixed with carbonate of potaſh, in a deliqueſcent ſtate.
Oil, philoſopher's	Empyreumatic fixed oils.
Oil of vitriol.	Sulphuric acid.
Oil of wine, ſweet.	Ethereal oil.
Oils, empyreumatic.	Empyreumatic oils.
Oils, ethereal.	Volatile oils.
Oils, fat.	Fixed oils.
Oils, eſſential.	Volatile oils.
Oils by expreſſion.	Fixed oils.
Ore of antimony.	Native ſulphure of antimony.
Ore of iron, from marſhes.	Iron ore, containing phoſphate of iron.
Orpiment.	Yellow ſulphurated oxide of arſenic.
Oxygene.	Oxygene.
	P
Phlogiſton.	Imaginary principle of Stahl.
Philoſophic wool.	Sublimated oxide of zinc.
Phoſphate ammoniacal.	Ammoniacal phoſphate. Phoſphate of ammoniac.
Phoſphate, barotic.	Barytic phoſphate. Phoſphate of barytes.
Phoſphate, calcareous.	Calcareous phoſphate. Phoſphate of lime.
Phoſphate of magneſia.	Magneſian phoſphate. Phoſphate of magneſia.
Phoſphate of potaſh.	Phoſphate of potaſh.
Phoſphate of ſoda.	Phoſphate of ſoda.
Phoſphorus of Baudouin.	Dry calcareous nitrate.
Phoſphorus of Kunckel.	Phoſphorus.
Phoſphorus of Homberg.	Dry calcareous muriate.
Ponderous ſtone.	Calcareous tunſtate.
Platina.	Platina.
Plaſter.	Calcareous ſulphate, *or* calcined plaſter.
Plumbago.	Carbure of iron.
Pompholyx.	Sublimated oxide of zinc.

P

Old Names.	*New Names.*
Potaſhes of commerce.	Impure carbonate of potaſh.
Putty of tin.	Grey oxide of tin.
Powder of Algaroth.	Oxide of antimony by muriatic acid.
Powder of Count Palma. *Powder of Sentinelly.*	Carbonate of magneſia.
Precipitate, white, by muriatic acid.	Mercurial muriate by precipitation.
Precipitate of gold by tin, or *purple of Caſſius.*	Oxide of gold precipitated by tin.
Precipitate, yellow.	Yellow oxide of mercury by ſulphuric acid.
Precipitate per ſe.	Red oxide of mercury by fire.
Precipitate, red.	Red oxide of mercury by nitric acid.
Principle, acidifying.	Oxygene.
Principle, aſtringent.	Gallic acid.
Principle, carbonaceous.	Carbone.
Principle, inflammable. (See *phlogiſton.*)	
Principle, mercurial.	Imaginary principle of Beccher.
Principium ſorbile of M. Ludbock.	Oxygene.
Pruſſite, calcareous.	Calcareous pruſſiate. Pruſſiate of lime.
Pruſſite of potaſh.	Pruſſiate of potaſh.
Pruſſite of ſoda.	Pruſſiate of ſoda.
Pyrites of copper.	Sulphure of copper.
Pyrites, martial.	Sulphure of iron.
Pyrophorus of Homberg.	Carbonated ſulphure of alumine Pyrophorus of Homberg.

R

Old Names.	*New Names.*
Rea'gar, or *realgal.*	Red ſulphurated oxide of arſenic
Regaltes, (*ſalts formed with aqua regia*)	Nitro-muriates.
Regia, aqua.	Nitro-muriatic acid.
Regulus.	*A word uſed to denote the* pur metallic ſtate, *in oppoſition* t ores, *and* oxides.
Regulus of antimony.	Antimony.
Regulus of arſenic.	Arſenic.

Old Names.	New Names.
R	
Regulus of cobalt.	Cobalt.
Regulus of manganeſe.	Manganeſe.
Regulus of molybdena.	Molybdena.
Regulus of ſyderite.	Phoſphure of iron.
Reſins	Reſins.
Ruſt of copper.	Green oxide of copper.
Ruſt of iron.	Carbonate of iron.
Rubine of antimony.	Sulphurated oxide of antimony.
Red nitrated mercury.	Red oxide of mercury by nitric acid.
S	
Saffron of mars.	Oxide of iron.
Saffron, aperient, of mars.	Carbonate of iron.
Saffron, aſtringent, of mars.	Brown oxide of iron.
Saffron of metals.	Semi-vitreous ſulphurated oxide of antimony.
Saltpetre.	Nitrate of potaſh, *or* nitre.
Saturn.	Lead.
Soaps, acid.	Acid ſoaps.
Soaps, alkaline.	Alkaline ſoaps.
Soaps, earthy, or *oleo-terrene combinations of M. Berthollet.*	Earthy ſoaps.
Soaps, metallic, or *oleo-metallic combinations of M. Berthollet.*	Metallic ſoaps.
Soap of Starkey.	Saponula of potaſh.
Sebates, (ſalts.)	Sebates.
Salt, ammoniacal acetous.	Ammoniacal acetite. Acetite of ammoniac.
Salt, calcareous acetous.	Calcareous acetite. Acetite of lime.
Salt, acetous of clay.	Aluminous acetite. Acetite of alumine.
Salt, acetous of zinc.	Acetite of zinc.
Salt, magneſian acetous.	Magneſian acetite. Acetite of magneſia.
Salt, acetous martial.	Acetite of iron.
Salt, acetous mineral.	Acetite of ſoda.
Sal admirabile perlatum.	Superſaturatedphoſphateofſoda.
Sal Alembroth.	Ammoniaco-mercurial muriate.

S

Old Names.	*New Names.*
Sal ammoniac.	Ammoniacal muriate. Muriate of ammoniac.
Salt, cretaceous ammoniacal.	Ammoniacal carbonate.
Sal ammoniac, fixed.	Calcareous muriate. Muriate of lime.
Salt ammoniacal, nitrous.	Ammoniacal nitrate. Nitrate of ammoniac.
Salt ammoniacal, (a ſecret of Glauber's.)	Ammoniacal ſulphate. Sulphate of ammoniac.
Salt, bitter cathartic.	Magneſian ſulphate. Sulphate of magneſia.
Salt, ammoniacal ſedative.	Ammoniacal borate. Borate of ammoniac.
Salt, ammoniacal ſparry.	Ammoniacal fluate. Fluate of ammoniac.
Salt, ammoniacal vitriolic.	Ammoniacal ſulphate. Sulphate of ammoniac.
Salt, common.	Muriate of ſoda.
Salt, Engliſh.	Ammoniacal carbonate. Carbonate of ammoniac.
Salt of colcothar.	Sulphate of iron, *(its particular ſtate not well known.)*
Salt, kitchen.	Muriate of ſoda.
Salt, Glauber's.	Sulphate of ſoda
Salt of Jupiter.	Muriate of tin.
Salt of milk.	Sugar of milk.
Salt of wiſdom.	Ammoniaco-mercurial muriate.
Salt of Epſom.	Magneſian ſulphate. Sulphate of magneſia.
Sal de Duobus.	Sulphate of potaſh.
Salt of Scheidſchutz.	Sulphate of magneſia.
Salt of Sedlitz.	Sulphate of magneſia.
Salt of Segner.	Sebate of potaſh.
Salt of Seignette.	Tartarite of ſoda.
Salt of amber, obtained by cryſtallization.	Cryſtalliſed ſuccinic acid.
Salt of ſorrel.	Acidulous oxalate of potaſh.
Salt, febrifuge, of Sylvius.	Muriate of potaſh.
Salt, fixed, of tartar.	Carbonate of potaſh not ſaturated.
Salt, fuſible, of urine.	Phoſphate of ſoda and ammoniac.
Sal gem.	Foſſil muriate of ſoda.

S

Old Names.	*New Names.*
Salt, marine.	Muriate of ſoda.
Salt, argillaceous marine.	Aluminous muriate. Muriate of alumine.
Salt, barotic marine.	Barytic muriate. Muriate of barytes.
Salt, calcareous marine.	Calcareous muriate. Muriate of lime.
Salt, marine, of iron.	Muriate of iron.
Salt, marine, of zinc.	Muriate of zinc.
Salt, magneſian marine.	Magneſian muriate. Muriate of magneſia.
Salt, native, of urine.	Phoſphate of ſoda and ammoniac.
Salt, neutral arſeniacal, of Macquer.	Acidulous arſeniate of potaſh.
Salt or *ſugar of ſaturn.*	Acetite of lead.
Salt, polychreſt, of Glaſer.	Sulphate of potaſh.
Salt, polychreſt, of Rochelle.	Tartarite of ſoda.
Salt, regaline, of gold.	Muriate of gold.
Salt, ſedative.	Boracic acid.
Salt, ſedative mercurial.	Borate of mercury.
Salt, ſublimated ſedative.	Sublimated boracic acid.
Salt, ſtanno-nitrous	Nitrate of tin.
Salt, ſulphureous, of Stahl.	Sulphate of potaſh.
Salt, vegetable.	Tartarite of potaſh.
Salt, volatile, of England.	Ammoniacal carbonate.
Salt, volatile, of amber.	Sublimated ſuccinic acid.
Selenite.	Sulphate of lime.
Smalt.	Oxide of cobalt vitrified with ſilex, or *ſmalt*.
Soda, cauſtic.	Soda.
Soda, cretaceous.	Carbonate of ſoda.
Soda, ſpathoſe.	Fluate of ſoda.
Sulphur.	Sulphur.
Sulphur, gilded, of antimony.	Sulphurated, orange, oxide of antimony.
Spar, ammoniacal.	Ammoniacal fluate.
Spar, calcareous.	Carbonate of lime.
Spar, fluor.	Calcareous fluate.
Spar, ponderous.	Sulphate of barytes.
Spiritus ſylveſtris.	Carbonic acid.
Snow of antimony.	White ſublimated oxide of antimony.

S

Old Names.	*New Names.*
Spirit, acid, of wood.	Pyro-ligneous acid.
Spirit, volatile alkaline.	Gas ammoniac, *or* ammoniacal gas.
Spirit, ardent, or *ſpirit of wine.*	Alcohol.
Spirit of Mendererus.	Ammoniacal acetite.
Spirit of nitre.	Nitric acid diluted in water.
Spirit, fuming, of nitre.	Nitrous acid.
Spirit, dulcified, of nitre.	Nitric alcohol.
Spirit of ſalt.	Muriatic acid.
Spirit of ſal ammoniac.	Ammoniac.
Spirit of wine.	Alcohol.
Spirit of vitriol.	Sulphuric acid diluted in water.
Spirit of Venus.	Acetic acid.
Spiritus rector.	Aroma.
Spirits, acid.	Acids diluted in water.
Spirit, volatile, of ſal ammoniac.	Ammoniac diluted in water.
Sublimate, corroſive.	Corroſive muriate of mercury.
Sublimate, mild.	Mild muriate of mercury.
Lemon, or *citron juice.*	Citric acid.
Semi-metals.	Semi-metals.
Succinum.	Amber.
Stone, infernal.	Melted nitrate of ſilver.
Sugar.	Sugar.
Sugar candy.	Cryſtalliſed ſugar.
Sugar of ſaturn.	Acetite of lead.
Sugar or *ſalt of milk.*	Sugar of milk.
Syderite.	Phoſphate of iron.
Stearch.	Stearch.
Syderotete of M. de Morveau.	Phoſphure of iron.
Steel.	Steel.
Stone in the bladder.	Lithic acid.

T

Old Names.	*New Names.*
Tartar.	Acidulous tartarite of potaſh.
Tartar, ammoniacal.	Ammoniacal tartarite.
Tartar, antimoniated.	Antimoniated tartarite of potaſh.
Tartar, calcareous.	Tartarite of lime.
Tartar chalybeate.	Ferruginous tartarite of potaſh.
Tartar, cretaceous.	Carbonate of potaſh.
Tartar, crude.	Tartar.

T

Old Names.	*New Names.*
Tartar, cupreous.	Tartarite of copper.
Tartar of magneſia.	Tartarite of magneſia.
Tartar of potaſh.	Tartarite of potaſh.
Tartar of ſoda.	Tartarite of ſoda.
Tartar, emetic.	Antimoniated tartarite of potaſh.
Tartar, ſoluble martial.	Ferruginous tartarite of potaſh.
Tartar, mephitic.	Carbonate of potaſh.
Tartar, mercurial.	Mercurial tartarite.
Tartar, ſaturnine.	Tartarite of lead.
Tartar, ſpathoſe.	Fluate of potaſh.
Tartar, ſoluble.	Tartarite of potaſh.
Tartar, ſtibiated.	Antimoniated tartarite of potaſh.
Tartar, tartariſed.	Tartarite of potaſh.
Tartar, tartariſed, containing antimony.	Tartarite of potaſh, with an addition of antimony.
Tartar, vitriolated.	Sulphate of potaſh.
Tartar, acrid tincture of.	Alcohol of potaſh.
Tinctures, ſpiritous.	Reſinous alcohol.
Terra animalis.	Calcareous phoſphate. Phoſphate of lime.
Terrene baſe of alum.	Alumine.
Terrene baſe of ponderous ſpar.	Barytes.
Terra calcaria.	Lime, *or* calcareous earth.
Terra aluminæ.	Alumin.
Terra foliata, cryſtalliſable.	Acetite of ſoda.
Terra foliata tartaria.	Acetite of potaſh.
Terra foliata mercurialis.	Acetite of mercury.
Terra mineralis.	Acetite of ſoda.
Terra magneſiana.	Carbonate of magneſia.
Terra muriatica of M. Kirwan.	Magneſia.
Terra ponderoſa.	Barytes.
Terra ponderoſa aerated.	Carbonate of barytes.
Terra ſilicea.	Silex, *or* ſiliceous earth.
Tungſtic ſalts.	Tunſtates.
Tungſtic ammoniacal.	Ammoniacal tunſtate.
Tungſtic of potaſh.	Tunſtate of potaſh.
Turbith, mineral.	Yellow mercurial oxide by ſulphuric acid.
Turbith, nitrous.	Yellow mercurial oxide by nitrous acid.
Tin.	Tin.
Tin, corneous.	Muriate of tin.

V

Old Names.	*New Names.*
Verdegris.	Green oxide of copper.
Verdigris of commerce.	Acetite of copper, with an exceſs of oxide of copper.
Venus.	Copper.
Verdet (Fr.), or *verdigris.*	Acetite of copper.
Verdigris, diſtilled.	Cryſtalliſed acetite of copper.
Vitrum antimonii.	Vitrous ſulphurated oxide of antimony.
Vivum argentum.	Mercury.
Vinegar, diſtilled.	Acetous acid.
Vinegar of ſaturn.	Acetite of lead.
Vinegar, radical.	Acetic acid.
Vitriol, ammoniacal.	Ammoniacal ſulphate.
Vitriol, white.	Sulphate of zinc.
Vitriol, blue.	Sulphate of copper.
Vitriol, calcareous.	Sulphate of lime.
Vitriol of antimony.	Sulphate of antimony.
Vitriol of ſilver.	Sulphate of ſilver.
Vitriol of clay.	Sulphate of alumine.
Vitriol of biſmuth.	Sulphate of biſmuth.
Vitriol of lime.	Calcareous ſulphate.
Vitriol of Cyprus.	Sulphate of copper.
Vitriol of cobalt.	Sulphate of cobalt.
Vitriol of copper.	Sulphate of copper.
Vitriol of luna.	Sulphate of ſilver.
Vitriol of manganeſe.	Sulphate of manganeſe.
Vitriol of mercury.	Sulphate of mercury.
Vitriol of nickel.	Sulphate of nickel.
Vitriol of platina.	Sulphate of platina.
Vitriol of lead.	Sulphate of lead.
Vitriol of potaſh.	Sulphate of potaſh.
Vitriol of ſoda.	Sulphate of ſoda.
Vitriol of tin.	Sulphate of tin.
Vitriol of zinc.	Sulphate of zinc.
Vitriol, magneſian.	Sulphate of magneſia.
Vitriol, martial.	Sulphate of iron.
Vitriol, green.	Sulphate of iron.

W

Water.	Water.
Water, aerated.	Carbonic acid.

W

Old Names.	*New Names.*
Water, lime.	Lime-water.
Water, Pruſſian-lime.	Pruſſiate of lime.
Water, diſtilled.	Diſtilled water.
Water, ſtrong, or *aqua fortis.*	Nitric acid of commerce.
Waters, gazeous.	Waters impregnate with carbonic acid.
Waters, mothers.	Saline deliqueſcent reſidue.
Water, mercurial.	Nitrate of mercury in a ſtate of ſolution.
Water, royal, or *aqua regia.*	Nitro-muriatic acid.
Waters, acidulous.	Acidulous waters, or waters impregnated with carbonic acid.
Waters hepatic.	Sulphureous or ſulphurated waters.
Wolfram of Meſſrs d' Elhuyar.	Tungſten.

Z

Old Names.	*New Names.*
Zinc.	Zinc.
Zaffre.	Grey oxide of cobalt, with ſiliceous earth, or *zaffre.*

DIC-

DICTIONARY

FOR THE

NEW CHEMICAL NOMENCLATURE.

Old Names.	*New Names.*
	A
ACETATES. *Acetas, tis. ſ. m.*	These ſalts formed by the combination of the acetic acid (or radical vinegar) with different baſes. The following names, with which there are none ſynonymous in the ancient Nomenclature, belong to this genus.
Acetate, aluminous. ——— of alumine. *Acetas aluminoſus.*	
Acetate, ammoniacal. ——— of ammoniac *. *Acetas ammoniacalis.*	

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* For the future, we ſhall not repeat theſe two modes of expreſſing the baſe of a neutral ſalt together, but uſe them indifferently. Theſe inſtances already given, are enough to ſhow, that either the ſubſtantive or the adjective may be uſed, at pleaſure.

This obſervation extends alſo to the Latin Nomenclature.

A

New Names.	Old Names.
Acetate of antimony. *Acetas ſtibii.*	
Acetate of ſilver. *Acetas argenti.*	
Acetate of arſenic. *Acetas arſenici.*	
Acetate of barytes. *Acetas barytis*, or *barytæ.*	
Acetate of biſmuth. *Acetas biſmuthi.*	
Acetate of lime. *Acetas calcis.*	
Acetate of cobalt. *Acetas cobalti.*	
Acetate of copper. *Acetas cupri.*	
Acetate of tin. *Acetas ſtanni.*	
Acetate of iron. *Acetas ferri.*	
Acetate of magneſia. *Acetas magneſiæ.*	
Acetate of manganeſe. *Acetas magneſii.*	
Acetate of mercury. *Acetas hydrargyri.*	
Acetate of molybdena. *Acetas molybdeni.*	
Acetate of nickel. *Acetus niccoli.*	
Acetate of gold. *Acetas auri.*	
Acetate of platina. *Acetas platini.*	
Acetate of lead. *Acetas plumbi.*	

New Names.	A Old Names.
Acetate of potaſh. *Acetas potaſſæ.*	
Acetate of ſoda. *Acetas ſodæ.*	
Acetate of tungſten. *Acetas tunſteni.*	
Acetate of zinc. *Acetas zinci.*	
Acetite. *Acetis, itis. ſ. m.*	Salts formed by the union o the acetous acid, or diſtilled vinegar, with different baſes.
Acetite, aluminous. *Acetis aluminoſus.*	*Acetited clay.* *Acetous ſalt of clay.*
Acetite, ammoniacal. *Acetis ammoniacalis.*	*Ammoniacal aectite.* *Ammoniacal acetous ſalt.* *Spirit of Mendererus.*
Acetite of antimony. *Acetis ſtibii.*	
Acetite of ſilver. *Acetis argenti.*	
Acetite of arſenic. *Acetis arſenicalis.*	*Fuming arſenico-acetous liquor* *M. Cadet.*
Acetite of barytes. *Acetis baryticus.*	
Acetite of biſmuth. *Acetis biſmuthi.*	
Acetite of lime. *Acetis calcareus.*	*Acetited lime.* *Calcareous acetous ſalt.*
Acetite of cobalt. *Acetis cobalti.*	
Acetite of copper. *Acetis cupri.*	*Acetited copper.* *Verdigris.* *Diſtilled verdigris of commerce.* *Cryſtals of Venus.*
Acetite of tin. *Acetis ſtanni.*	

A

New Names.	Old Names.
Acetite of iron. *Acetis ferri.*	*Acetited iron.* *Martial acetous ſalt.*
Acetite of magneſia. *Acetis magneſiæ.*	*Magneſian acetous ſalt.* *Acetited magneſia.*
Acetite of mercury. *Acetis hydrargyri.*	*Acetited mercury.* *Terra foliata mercurialis.*
Acetite of molybdena. *Acetis molybdeni.*	
Acetite of nickel. *Acetis niccoli.*	
Acetite of gold. *Acetis auri.*	
Acetite of platina. *Acetis platini.*	
Acetite of lead. *Acetis plumbi.*	*Acetited lead.* *Vinegar of ſaturn.* *Salt* or *ſugar of ſaturn.*
Acetite of potaſh. *Acetis potaſſæ,* vel *potaſſeus.*	*Acetited potaſh.* *Terra foliata tartari.*
Acetite of ſoda. *Acetis ſodæ,* vel *ſodaceus.*	*Acetited ſoda.* *Mineral acetous ſalt.* *Terra foliata mineralis.* *Cryſtalliſable terra foliata.*
Acetite of tungſten. *Acetis tunſteni.*	
Acetite of zinc. *Acetis zinci.*	*Acetited zinc.* *Acetous ſalt of zinc.*
Acid, acetous. *Acidum acetoſum.*	*Acetous acid.* *Diſtilled vinegar.*
Acid, acetic. *Acidum aceticum.*	*Radical vinegar.* *Spirit of Venus.*
Acid, arſenic. *Acidum arſenicum.*	*Arſenical acid.*
Acid, benzoic. *Acidum benzoicum.*	*Benzonic acid.* *Acid of benzoin.* *Salt of benzoin.*
Acid, ſublimated benzoic. *Acidum benzoicum ſublimatum.*	*Flowers of benzoin.* *Volatile ſalt of benzoin.*

A

New Names.	Old Names.
Acid, bombic. *Acidum bombicum.*	*Acid of the ſilk worm.* *Bombycine acid.*
Acid, boracic. *Acidum boracicum.*	*Volatile narcotic ſalt of vitriol.* *Sedative ſalt.* *Acid of borax.* *Boracine acid.*
Acid, carbonic. *Acidum carbonicum.*	*Gas ſylveſtre.* *Spiritus ſylveſtris.* *Fixed air.* *Aërial acid.* *Atmoſpheric acid.* *Mephitic acid.* *Cretaceous acid.* *Carbonaceous acid.*
Acid, citric. *Acidum citricum.*	*Lemon juice.* *Citronian acid.*
Acid, fluoric. *Acidum fluoricum.*	*Fluoric acid.* *Spathoſe acid.*
Acid, formic. *Acidum formicum.*	*Acid of ants.* *Formicine acid.*
Acid, gallic. *Acidum gallæ,* ſeu *gallaceum.*	*Aſtringent principle.* *Gallic acid.*
Acid, lactic. *Acidum lacticum.*	*Sour whey.* *Galactic acid.*
Acid, lithic. *Acidum lithicum.*	*Acid of the ſtone in the bladder.* *Bezoardic acid.* *Lithiaſic acid.*
Acid, malic. *Acidum malicum.*	*Acid of apples.* *Maluſian acid.*
Acid, molybdic. *Acidum molybdicum.*	*Acid of molybdena.* *Molybdic acid.* *Acid of Wolfram.*
Acid, muriatic. *Acidum muriaticum.*	*Acid of marine ſalt.* *Fuming ſpirit of ſalt.* *Marine acid.*
Acid, oxigenated muriatic. *Acidum muriaticum oxigenatum.*	*Dephlogiſticated marine acid.* *Aërated marine acid.*

A

New Names.	Old Names.
Acid, nitrous. *Acidum nitroſum.*	*Ruddy nitrous acid.* *Phlogiſticated nitrous acid.* *Fuming nitrous acid.* *Fuming ſpirit of nitre.*
Acid, nitric. *Acidum nitricum.*	*White nitrous acid.* *Nitric acid without gas.* *Dephlogiſticated nitrous acid.*
Acid, nitro-muriatic. *Acidum nitro-muriaticum.*	*Aqua regia.* *Regaline acid.*
Acid, oxalic. *Acidum oxallicum.*	*Acid of ſorrel.* *Oxalline acid.* *Saccharine acid.* *Acid of ſugar.*
Acid, phoſphorus. *Acidum phoſphoroſum.*	*Volatile phoſphoric acid.*
Acid, phoſphoric. *Acidum phoſphoricum.*	*Phoſphoric acid.* *Acid of urine.*
Acid, pruſſic. *Acidum pruſſicum.*	*Colouring matter of Pruſſian blue.*
Acid, pyro-ligneous. *Acidum pyro-lignoſum.*	*Empyreumatic acid ſpirit of wood.*
Acid, pyro-mucous. *Acidum pyro mucoſum*	*Spirit of honey, ſugar,* &c. *Syrupous acid.*
Acid, pyro-tartarous. *Acidum pyro-tartaroſum.*	*Spirit of tartar.*
Acid, ſaccho lactic. *Acidum ſaccho-lacticum.*	*Acid of ſugar of milk.* *Saccho-lactic acid.*
Acid, ſebacic. *Acidum ſebacicum.*	*Sebaceous acid.* *Acid of tallow.*
Acid, ſuccinic. *Acidum ſuccinicum.*	*Acid of amber.* *Volatile ſalt of amber.*
Acid, ſulphureous. *Acidum ſulphuroſum.*	*Sulphureous acid.* *Volatile ſulphureous acid.* *Phlogiſticated vitriolic acid.* *Spirit of ſulphur.*
Acid, ſulphuric. *Acidum ſulphuricum.*	*Acid of ſulphur.* *Vitriolic acid.* *Oil of vitriol.* *Spirit of vitriol.*

A

New Names.	Old Names.
Acid, tartareous. *Acidum tartaroſum.*	*Tartareous acid.* *Acid of tartar.*
Acid tunſtic. *Acidum tunſticum.*	*Tungstic acid.* *Acid of tungsten.* *Acid of Wolfram.*
Affinity. *Affinitas.*	*Affinity.*
Aggregation. *Aggregatio.*	*Aggregation,*
Aggregates. *Aggregata.*	*Aggregates.*
Atmoſpheric air. *Aer atmoſphericus.*	*Atmoſpheric air.*
Alkalis. *Alkalia.*	*Alkalis in general.*
Alcohol. *Alcohol,* indecl.	*Spirit of wine.* *Ardent ſpirit.*
Alcohol of potaſh. *Alcohol potaſſæ.*	*Lilium of Paracelſus.* *Acrid tincture of tartar.*
Alcohol, nitric. *Alcohol nitricum.*	*Dulcified ſpirit of nitre.*
Alcohols, reſinous. *Alcohol reſinoſa.*	*Spiritous tinctures.*
Alloy. *Connubium metallicum.*	*Alloy of metals.*
Alumine. *Alumina.*	*Earth of alum.* *Baſe of alum.* *Pure clay.*
Amalgam.	*Amalgam.*
Ammoniac. *Ammoniaca.*	*Cauſtic volatile alkali.* *Fluor volatile alkali.* *Volatile ſpirit of ſal ammoniac*]
Antimony. *Antimonium, ſtibium.*	*Regulus of antimony.*
Aroma. *Aroma.*	*Spiritus rector.* *Odorate principle.*
Arſeniates. *Arſenias, tis. ſ. m.*	*Arſenical ſalts.*

A

New Names.	Old Names.
Acidulous arſeniate of potaſh. *Arſenias acidulus potaſſæ.*	*Macquer's arſenical neutral ſalt.*
Arſeniate of alumine. *Arſenias aluminæ.*	
Arſeniate of ammoniac. *Arſenias ammoniacæ,* ſeu *ammoniacalis.*	*Arſenical ammoniac.*
Arſeniate of ſilver. *Arſenias argenti.*	
Arſeniate of barytes. *Arſenias barytæ.*	
Arſeniate of biſmuth. *Arſenias biſmuthi.*	
Arſeniate of lime. *Arſenias calcis.*	
Arſeniate of cobalt. *Arſenias cobalti.*	
Arſeniate of copper. *Arſenias cupri.*	
Arſeniate of tin. *Arſenias ſtanni.*	
Arſeniate of iron. *Arſenias ferri.*	
Arſeniate of magneſia. *Arſenias magneſiæ.*	
Arſeniate of manganeſe. *Arſenias magneſii.*	
Arſeniate of mercury. *Arſenias hydrargyri.*	
Arſeniate of molybdena. *Arſenias molybdeni.*	
Arſeniate of nickel. *Arſenias niccoli.*	
Arſeniate of gold. *Arſenias auri.*	
Arſeniate of platina. *Arſenias platini.*	

New Names.	A	Old Names.
Arſeniate of lead. *Arſenias plumbi.*		
Arſeniate of potaſh. *Arſenias potaſſæ.*		
Arſeniate of ſoda. *Arſenias ſodæ.*		
Arſeniate of tungſten. *Arſenias tunſteni.*		
Arſeniate of zinc. *Arſenias zinci.*		
Azote.		*Baſe of atmoſpheric mephitiſe.*
	B	
Barytes, *or* baryta. *Baryta.*		*Terra ponderoſa.* *Earth of ponderous ſpar.* *Barotes.*
Balſams. *Balſama.*		*Balſams of Bucquet.* *
Benzoin. *Benzoe.*		*Benzoin.*
Benzoate. *Benzoas, tis. ſ. m.*		*Benzone.* A ſalt formed by the union of the benzoic acid with different baſes. Salts of this kind have no names in the old Nomenclature.
Benzoate of alumine. *Benzoas aluminoſus.*		
Benzoate of ammoniac. *Benzoas ammoniacalis.*		
Benzoate of antimony. *Benzoas ſtibii.*		

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* Reſins combined with a concrete acid ſalt.

B

New Names.	Old Names.
Benzoate of ſilver. *Benzoas argenti.*	
Benzoate of arſenic. *Benzoas arſenicalis.*	
Benzoate of barytes. *Benzoas baryticus.*	
Benzoate of biſmuth. *Benzoas biſmuthi.*	
Benzoate of lime. *Benzoas calcareus.*	
Benzoate of cobalt. *Benzoas cobalti.*	
Benzoate of copper. *Benzoas cupri.*	
Benzoate of tin. *Benzoas ſtanni.*	
Benzoate of iron. *Benzoas ferri.*	
Benzoate of magneſia. *Benzoas magneſiæ.*	
Benzoate of manganeſe. *Benzoas magneſii.*	
Benzoate of mercury. *Benzoas hydrargyri.*	
Benzoate of molybdena. *Benzoas molybdeni.*	
Benzoate of nickel. *Benzoas niccoli.*	
Benzoate of gold. *Benzoas auri.*	
Benzoate of platina. *Benzoas platini.*	
Benzoate of lead. *Benzoas plumbi.*	
Benzoate of potaſh. *Benzoas potaſſæ.*	

B

New Names.	Old Names.
Benzoate of ſoda. *Benzoas ſodæ.*	
Benzoate of tungſten. *Benzoas tunſteni.*	
Benzoate of zinc. *Benzoas zinci.*	
Biſmuth. *Biſmuthum.*	*Biſmuth.*
Bitumens. *Bitumina.*	*Bitumens.*
Bombiate. *Bombias, tis. ſ. m.*	Salts formed by the union of the bombic acid with different baſes. This genus of ſalts had no name in the old Nomenclature.
Bombiate of alumine. *Bombias aluminoſus.*	
Bombiate of ammoniac. *Bombias ammoniacalis.*	
Bombiate of antimony. *Bombias ſtibii.*	
Bombiate of ſilver. *Bombias argenti.*	
Bombiate of arſenic. *Bombias arſenicalis.*	
Bombiate of barytes. *Bombias baryticus.*	
Bombiate of biſmuth. *Bombias biſmuthi.*	
Bombiate of lime. *Bombias calcareus.*	
Bombiate of cobalt. *Bombias cobalti.*	
Bombiate of copper. *Bombias cupri.*	
Bombiate of tin. *Bombias ſtanni.*	

New Names.	B	Old Names.
Bombiate of iron. *Bombias ferri.*		
Bombiate of magneſia. *Bombias magneſiæ.*		
Bombiate of manganeſe. *Bombias magneſii.*		
Bombiate of mercury. *Bombias hydrargyri.*		
Bombiate of molybdena. *Bombias molybdeni.*		
Bombiate of nickel. *Bombias niccoli.*		
Bombiate of gold. *Bombias auri.*		
Bombiate of platina. *Bombias platini.*		
Bombiate of lead. *Bombias plumbi.*		
Bombiate of potaſh. *Bombias potaſſæ.*		
Bombiate of ſoda. *Bombias ſodæ.*		
Bombiate of tungſten. *Bombias tunſteni.*		
Bombiate of zinc. *Bombias zinci.*		
Borate. *Boras, tis. ſ. m.*		*Borax.*
Borate, aluminous. *Boras aluminoſus.*		*Argillaceous borax.*
Borate, ammoniacal. *Boras ammoniacalis.*		*Ammoniacal borax.* *Sedative ſal ammoniac.*
Borate of antimony. *Boras ſtibii.*		*Borax of antimony.*
Borate of ſilver. *Boras argenti.*		

B

New Names.	Old Names.
Borate of arſenic. *Boras arſenici.*	
Borate of barytes, *or* baryta. *Boras barytæ.*	*Ponderous* or *barotic borax.*
Borate of biſmuth. *Boras biſmuthi.*	
Borate of lime. *Boras calcis.*	
Borate of cobalt. *Boras cobalti.*	*Borax of cobalt.*
Borate of copper. *Boras cupri.*	*Borax of copper.*
Borate of tin. *Boras ſtanni.*	
Borate of iron. *Boras ferri.*	*Borax of iron.*
Borate of magneſia. *Boras magneſiæ.*	*Magneſian borax.*
Borate of manganeſe. *Boras magneſii.*	
Borate of mercury. *Boras mercurii.*	*Mercurial borax.* *Mercurial ſedative ſalt.*
Borate of molybdena. *Boras molybdeni.*	
Borate of nickel. *Boras niccoli.*	
Borate of gold. *Boras auri.*	
Borate of platina. *Boras platini.*	
Borate of lead. *Boras plumbi.*	
Borate of potaſh. *Boras potaſſæ.*	*Vegetable borax.*
Borate of ſoda. *Boras ſodæ.*	*Common borax ſaturated with boracic acid.*

New Names.	Old Names.
B	
Borate of tungſten. *Boras tunſteni.*	
Borate of zinc. *Boras zinci.*	*Borax of zinc.*
Borate of ſoda, *or* borate ſuperſaturated with ſoda.	*Crude borax.* *Tinckal.* *Chryſocolla.* *Borax of commerce.*
C	
Caloric. *Caloricum.*	*Latent heat.* *Fixed heat.* *Principle of heat.*
Camphor. *Camphora.*	*Camphor.*
Camphorate. *Camphoras, tis. ſ. m.*	A ſalt formed by the combination of camphoric acid with different baſes. Theſe ſalts were not known formerly; and accordingly they have no names in the old Nomenclature.
Camphorate of alumine. *Camphoras aluminoſus.*	
Camphorate of ammoniac. *Camphoras ammoniacalis.*	
Camphorate of antimony. *Camphoras ſtibii.*	
Camphorate of ſilver. *Camphoras argenti.*	
Camphorate of arſenic. *Camphoras arſenicalis.*	
Camphorate of barytes. *Camphoras baryticus.*	

C

New Names.	Old Names.
Camphorate of biſmuth. *Camphoras biſmuthi.*	
Camphorate of lime. *Camphoras calcareus.*	
Camphorate of cobalt. *Camphoras cobalti.*	
Camphorate of copper. *Camphoras cupri.*	
Camphorate of tin. *Camphoras ſtanni.*	
Camphorate of iron. *Camphoras ferri.*	
Camphorate of magneſia. *Camphoras magneſiæ.*	
Camphorate of manganeſe. *Camphoras magneſii.*	
Camphorate of mercury. *Camphoras mercurii.*	
Camphorate of molybdena. *Camphoras molybdeni.*	
Camphorate of nickel. *Camphoras niccoli.*	
Camphorate of gold. *Camphoras auri.*	
Camphorate of platina. *Camphoras platini.*	
Camphorate of lead. *Camphoras plumbi.*	
Camphorate of potaſh. *Camphoras potaſſæ.*	
Camphorate of ſoda. *Camphoras ſodæ.*	
Camphorate of tungſten. *Camphoras tunſteni.*	
Camphorate of zinc. *Camphoras zinci.*	

C

New Names	Old Names.
Carbone. *Carbonicum.*	*Pure coal.*
Carbonate. *Carbonas, tis, ſ. m.*	A ſalt formed by the union of carbonic acid with different baſes.
Carbonate of alumine. *Carbonas aluminoſus.*	*Cretaceous clay.*
Carbonate, ammoniacal. *Carbonas ammoniacæ.*	*Ammoniacal chalk.* *Cretaceous ammoniacal ſalt.* *Concrete volatile alkali.* *Ammoniacal mephite.* *Engliſh ſal volatile.*
Carbonate of antimony. *Carbonas antimonii.*	
Carbonate of ſilver. *Carbonas argenti.*	
Carbonate of arſenic. *Carbonas arſenici.*	
Carbonate of barytes. *Carbonas baryticus.*	*Barotic or ponderous chalk.* *Aërated ponderous earth.* *Efferveſcent barotes.* *Barotic mephite.*
Carbonate of biſmuth. *Carbonas biſmuthi.*	
Calcareous carbonate. *Carbonas calcareus.*	*Chalk.* *Limeſtone.* *Calcareous mephite.* *Aërated calcareous earth.* *Efferveſcent calcareous earth.* *Calcareous ſpar.* *Cream of lime.*
Carbonate of cobalt. *Carbonas cobalti.*	
Carbonate of copper. *Carbonas cupri.*	
Carbonate of tin. *Carbonas ſtanni.*	

S

New Names.	Old Names.
Carbonate of iron. *Carbonas ferri.*	*Aperient ſaffron of mars.* *Ruſt of iron.* *Aerated iron.* *Martial chalk.* *Martial mephite.*
Carbonate of magneſia. *Carbonas magneſiæ.*	*Magneſian earth.* *White Magneſia.* *Aerated magneſia of Bergman.* *Cretaceous magneſia.* *Magneſian chalk.* *Efferveſcent magneſia.* *Mephite of magneſia.* *Kirwan's muriatic earth.* *Powder of Count Palma,* and *of Sentinelli.*
Carbonate of manganeſe. *Carbonas magneſii.*	
Carbonate of mercury. *Carbonas hydrargyri.*	
Carbonate of molybdena. *Carbonas molybdeni.*	
Carbonate of nickel. *Carbonas niccoli.*	
Carbonate of gold. *Carbonas auri.*	
Carbonate of platina. *Carbonas platini.*	
Carbonate of lead. *Carbonas plumbi.*	*Chalk of lead.* *Spathoſe lead.* *Mephite of lead.*
Carbonate of potaſh. *Carbonas potaſſæ.*	*Fixed ſalt of tartar.* *Vegetable fixed alkali.* *Aerated vegetable fixed alkali.* *Cretaceous tartar.* *Mephitic tartar.* *Mephite of potaſh.* *Nitre fixed by itſelf.* *Alkaheſt of Van Helmont.*

T

New Names.	Old Names.
Carbonate of ſoda. *Carbonas ſodæ.*	*Natrum or Natron.* *Baſe of marine ſalt.* *Marine or mineral alkali.* *Cryſtals of ſoda.* *Cretaceous ſoda.* *Aerated ſoda.* *Effervеſcent ſoda.* *Mephite of ſoda.* *Aerated mineral fixed alkali.* *Effervеſcent mineral fixed alkali.* *Chalk of ſoda.*
Carbonate of tungſten. *Carbonas tunſteni.*	
Carbonate of zinc. *Carbonas zinci.*	*Chalk of zinc.* *Aerated zinc.* *Mephite of zinc.*
Carbure of iron.	*Plumbago.*
Calcareous earth or lime, diluted in water.	*Milk of lime.*
Calcareous earth or lime.	*Calcareous earth.* *Quicklime.*
Citrate. *Citras, tis, ſ. m.*	A ſalt formed by the combination of the acid of citrons with different baſes. This ſalt had no name in the old nomenclature.
Citrate of alumine. *Citras aluminoſus.*	
Citrate of ammoniac. *Citras ammoniacalis.*	
Citrate of antimony. *Citras ſtibii.*	
Citrate of ſilver. *Citras argenti.*	
Citrate of arſenic. *Citras arſenicalis.*	
Citrate of barytes. *Citras baryticus.*	

New Names.	A	Old Names.
Citrate of biſmuth. *Citras biſmuthi.*		
Citrate of lime. *Citras calcareus.*		
Citrate of cobalt. *Citras cobalti.*		
Citrate of copper. *Citras cupri.*		
Citrate of tin. *Citras ſtanni.*		
Citrate of iron. *Citras ferri.*		
Citrate of magneſia. *Citras magneſiæ.*		
Citrate of manganeſe. *Citras magneſii.*		
Citrate of mercury. *Citras mercurii.*		
Citrate of molybdena. *Citras molybdeni.*		
Citrate of nickel. *Citras niccoli.*		
Citrate of gold. *Citras auri.*		
Citrate of platina. *Citras platini.*		
Citrate of lead. *Citras plumbi.*		
Citrate of potaſh. *Citras potaſſæ.*		
Citrate of ſoda. *Citras ſodæ.*		
Citrate of tungſten. *Citras tunſteni.*		
Citrate of zinc. *Citras zinci.*		

C

New Names.	Old Names.
Clay, a mixture of aluminous and ſiliceous earth, *argilla.*	*Clay.* *Potter's earth.* *Argillaceous earth.*
Cobalt.	*Regulus of cobalt.* *Cobalt,* or *cobolt.*
Copper. *Cuprum.*	*Copper.* *Venus.*

D

New Names.	Old Names.
Diamond.	*Diamond.*

E

New Names.	Old Names.
Ether, acetic. *Ether aceticum.*	*Acetous ether.*
Ether, muriatic. *Ether muriaticum.*	*Marine ether.*
Ether, nitric. *Ether nitricum.*	*Nitrous ether.*
Ether, ſulphuric. *Ether ſulphuricum.*	*Vitriolic ether.*
Extractive principle. *Extractum.*	*Extract.*

F

New Names.	Old Names.
Fecula. *Fecula.*	*Fecula of plants.*
Fluate. *Fluas, tis. ſ. m.*	A ſalt formed by the combination of the fluoric acid with different baſes.
Fluate of alumine. *Fluas aluminæ.*	*Argillaceous fluor.* *Spathoſe clay.*

F

New Names.	Old Names.
Fluate, ammoniacal. *Fluas ammoniacalis.*	*Ammoniacal ſparry ſalt.* *Sparry ammoniac.* *Ammoniacal ſpar.* *Ammoniacal fluor.*
Fluate of antimony. *Fluas ſtibii.*	
Fluate of ſilver. *Fluas argenti.*	
Fluate of arſenic. *Fluas arſenicalis.*	
Fluate of barytes. *Fluas barytæ.*	*Ponderous fluor.* *Barotic fluor.*
Fluate of biſmuth. *Fluas biſmuthi.*	
Fluate of lime. *Fluas calcareus.*	*Fluor ſpar.* *Vitreous ſpar.* *Cubic ſpar.* *Phoſphoric ſpar.* *Sparry fluor.*
Fluate of cobalt. *Fluas cobalti.*	
Fluate of copper. *Fluas cupri.*	
Fluate of tin. *Fluas ſtanni.*	
Fluate of iron. *Fluas ferri.*	
Fluate of magneſia. *Fluas magneſiæ.*	*Fluorated magneſia.* *Sparry magneſia.* *Magneſian fluor.*
Fluate of manganeſe. *Fluas magneſii.*	
Fluate of mercury. *Fluas mercurii.*	
Fluate of molybdena. *Fluas molybdeni.*	
Fluate of nickel. *Fluas niccoli.*	

F

New Names.	Old Names.
Fluate of gold. *Fluas auri.*	
Fluate of platina. *Fluas platini.*	
Fluate of lead. *Fluas plumbi.*	
Fluate of potaſh. *Fluas potaſſæ.*	*Tartareous fluor.* *Sparry tartar.*
Fluate of ſoda. *Fluas ſodæ.*	*Fluor of ſoda.* *Sparry ſoda.*
Fluate of tungſten. *Fluas tunſteni.*	
Fluate of zinc. *Fluas zinci.*	
Formiate. *Formias, tis. ſ. m.*	Salt formed by the combination of the formic acid with different baſes. This genus of ſalt has no name in the old nomenclature.
Formiate of alumine. *Formias aluminoſus.*	
Formiate of ammoniac. *Formias ammoniacalis.*	
Formiate of antimony. *Formias ſtibii.*	
Formiate of ſilver. *Formias argenti.*	
Formiate of arſenic. *Formias arſenicalis.*	
Formiate of barytes. *Formias baryticus.*	
Formiate of biſmuth. *Formias biſmuthi.*	
Formiate of lime. *Formias calcareus.*	

New Names. **F** **Old Names.**

Formiate of cobalt.
Formias cobalti.

Formiate of copper.
Formias cupri.

Formiate of tin.
Formias ſtanni.

Formiate of iron.
Formias ferri.

Formiate of magneſia.
Formias magneſiæ.

Formiate of manganeſe.
Formias magneſii.

Formiate of mercury.
Formias mercurii.

Formiate of molybdena.
Formias molybdeni.

Formiate of nickel.
Formias niccoli.

Formiate of gold.
Formias auri.

Formiate of platina.
Formias platini.

Formiate of lead.
Formias plumbi.

Formiate of potaſh.
Formias potaſſæ.

Formiate of ſoda.
Formias ſodæ.

Formiate of tungſten.
Formias tunſteni.

Formiate of zinc.
Formias zinci.

G

New Names.	Old Names:
Gas. *Gas.*	*Gas.* *Elaſtic fluids.* *Aëriform fluids.*
Gas, acetous acid. *Gas acidum acetoſum.*	*Acetous acid gas.*
Gas, carbonic acid. *Gas acidum carbonicum.*	*Fixed air.* *Solid air of Hales.* *Cretaceous acid gas.* *Mephitic gas.* *Aërial acid.*
Gas, fluoric acid. *Gas acidum fluoricum.*	*Sparry acid gas.* *Fluoric acid gas.*
Gas, muriatic acid. *Gas acidum muriaticum.*	*Marine air.* *Marine acid gas.* *Muriatic acid gas.*
Gas, oxigenated muriatic acid. *Gas acidum muriaticum oxigenatum.*	*Aërated muriatic acid gas.* *Dephlogiſticated marine acid.*
Gas, nitrous acid. *Gas acidum nitroſum.*	*Nitrous acid gas.*
Gas, pruſſic acid. *Gas acidum pruſſicum.*	*Pruſſian gas.*
Gas, ſulphureous acid. *Gas acidum ſulphureum.*	*Sulphureous acid gas.* *Vitriolic acid air.*
Gas, ammoniacal. *Gas ammoniacale.*	*Alkaline gas.* *Alkaline air.* *Volatile alkaline gas.*
Gas, azotic. *Gas azoticum.*	*Vitiated air.* *Impure air.* *Phlogiſticated air.* *Phlogiſticated gas.* *Atmoſpheric mephitis.*
Gas, hydrogenous. *Gas hydrogenium.*	*Inflammable gas.* *Inflammable air.* *Phlogiſton of Mr Kirwan.*

G

New Names.	Old Names.
Gas, carbonated hydrogenous. *Gas hydrogenium carbonatum.*	*Carbonaceous inflammable gas.*
Gas, hydrogenous, of marſhes. *Gas hydrogenium paludum.*	*Mephitized inflammable gas.* *Inflammable gas of marſhes.*
Gas, phoſphorized hydrogenous. *Gas hydrogenium phoſphoriſatum.*	*Phoſphoric gas.*
Gas, ſulphurated hydrogenous. *Gas hydrogenium ſulphuratum.*	*Hepatic gas.*
Gas nitrous. *Gas nitroſum.*	*Nitrous gas.*
Gas, oxigenous. *Gas oxigenium.*	*Vital air.* *Pure air.* *Dephlogiſticated air.*
Gluten, *or* the glutinous principle. *Gluten.*	*Gluten of farina or of wheat.* *Vegeto-animal matter.*
Gold. *Aurum.*	*Gold.*

I

Iron. *Ferrum.*	*Iron.*

K

Lactate. *Lactas, tis. ſ. m.*	Salts formed by the union of the acid of ſour whey, or the lactic acid, with different baſes. Theſe ſalts were not known before Scheele; and their properties being as yet but little examined, they have hitherto received no name.

L

New Names.	Old Names:
Lactate of alumine. *Lactas aluminoſus.*	
Lactate of ammoniac. *Lactas ammoniacalis.*	
Lactate of antimony. *Lactas ſtibii.*	
Lactate of ſilver. *Lactas argenti.*	
Lactate of arſenic. *Lactas arſenicalis.*	
Lactate of barytes. *Lactas baryticus.*	
Lactate of biſmuth. *Lactas biſmuthi.*	
Lactate of lime. *Lactas calcareus.*	
Lactate of cobalt. *Lactas cobalti.*	
Lactate of copper. *Lactas cupri.*	
Lactate of tin. *Lactas ſtanni.*	
Lactate of iron. *Lactas ferri.*	
Lactate of magneſia. *Lactas magneſiæ.*	
Lactate of manganeſe. *Lactas magneſii.*	
Lactate of mercury. *Lactas hydrargyri.*	
Lactate of molybdena. *Lactas molybdeni.*	
Lactate of nickel. *Lactas niccoli.*	
Lactate of gold. *Lactas auri.*	

L

New Names.	Old Names.
Lactate of platina. *Lactas platini.*	
Lactate of lead. *Lactas plumbi.*	
Lactate of potaſh. *Lactas potaſſæ.*	
Lactate of ſoda. *Lactas ſodæ.*	
Lactate of tungſten. *Lactas tunſteni.*	
Lactate of zinc. *Lactas zinci.*	
Lead. *Plumbum.*	*Lead.* *Saturn.*
Light.	*Light.*
Lithiate. *Lithias, tis. ſ. m.*	Salts formed by the union of the lithic acid, or urinary calculus, with different baſes. Theſe ſalts are not comprehended in the ancient Nomenclature, being unknown before Scheele.
Lithiate of alumine. *Lithias aluminoſus.*	
Lithiate of ammoniac. *Lithias ammoniacalis.*	
Lithiate of antimony. *Lithias ſtibii.*	
Lithiate of ſilver. *Lithias argenti.*	
Lithiate of arſenic. *Lithias arſenicalis.*	
Lithiate of barytes. *Lithias baryticus.*	
Lithiate of biſmuth. *Lithias biſmuthi.*	
Lithiate of lime. *Lithias calcareus.*	

L

New Names.	Old Names.
Lithiate of cobalt. *Lithias cobalti.*	
Lithiate of copper. *Lithias cupri.*	
Lithiate of tin. *Lithias ſtanni.*	
Lithiate of iron. *Lithias ferri.*	
Lithiate of magneſia. *Lithias magneſiæ.*	
Lithiate of manganeſe. *Lithias magneſii.*	
Lithiate of mercury. *Lithias hydrargyri.*	
Lithiate of molybdena. *Lithias molybdeni.*	
Lithiate of nickel. *Lithias niccoli.*	
Lithiate of gold. *Lithias auri.*	
Lithiate of platina. *Lithias platini.*	
Lithiate of lead. *Lithias plumbi.*	
Lithiate of potaſh. *Lithias potaſſæ.*	
Lithiate of ſoda. *Lithias ſodæ.*	
Lithiate of tungſten. *Lithias tunſteni.*	
Lithiate of zinc. *Lithias zinci.*	

M

Malate. *Malas, tis. ſ. m.*	Salts formed by the union of the malic acid, or acid of apples, with different baſes. This genus of ſalts has not yet obtained a name in the old Nomenclature.

New Names. **M** Old Names.

Malate of alumine.
Malas aluminoſus.
Malate of ammoniac.
Malas ammoniacalis.
Malate of antimony.
Malas ſtibii.
Malate of ſilver.
Malas argenti.
Malate of arſenic.
Malas arſenicalis.
Malate of barytes.
Malas baryticus.
Malate of biſmuth.
Malas biſmuthi.
Malate of lime.
Malas calcareus.
Malate of cobalt.
Malas cobalti.
Malate of copper.
Malas cupri.
Malate of tin.
Malas ſtanni.
Malate of iron.
Malas ferri.
Malate of magneſia.
Malas magneſiæ.
Malate of manganeſe.
Malas magneſii.
Malate of mercury.
Malas hydrargyri.
Malate of molybdena.
Malas molybdeni.
Malate of nickel.
Malas niccoli.
Malate of gold.
Malas auri.
Malate of platina.
Malas platini.

M

New Names.	Old Names.
Malate of lead. *Malas plumbi.*	
Malate of potaſh. *Malas potaſſæ.*	
Malate of ſoda. *Malas ſodæ.*	
Malate of tungſten. *Malas tunſteni.*	
Malate of zinc. *Malas zinci.*	
Manganeſe. *Magneſium.*	*Regulus of manganeſe.*
Mercury. *Hydrargyrum.*	*Mercury.* *Quickſilver.*
Molybdate. *Molybdas, tis. ſ. m.*	Salt formed by the union of the molybdic acid with different baſes. This genus of ſalts had no name in the old Nomenclature.
Molybdate of alumine. *Molybdas aluminoſus.*	
Molybdate of ammoniac. *Molybdas ammoniacalis.*	
Molybdate of antimony. *Molybdas ſtibii.*	
Molybdate of ſilver. *Molybdas argenti.*	
Molybdate of arſenic. *Molybdas arſenicalis.*	
Molybdate of barytes. *Molybdas baryticus.*	
Molybdate of biſmuth. *Molybdas biſmuthi.*	
Molybdate of lime. *Molybdas calcareus.*	
Molybdate of cobalt. *Molybdas cobalti.*	
Molybdate of copper. *Molybdas cupri.*	

M

New Names.	Old Names.
Molybdate of tin. *Molybdas ſtanni.*	
Molybdate of iron. *Molybdas ferri.*	
Molybdate of magneſia. *Molybdas magneſiæ.*	
Molybdate of manganeſe. *Molybdas magneſii.*	
Molybdate of mercury. *Molybdas hydrargyri.*	
Molybdate of nickel. *Molybdas niccoli.*	
Molybdate of gold. *Molybdas auri.*	
Molybdate of platina. *Molybdas platini.*	
Molybdate of lead. *Molybdas plumbi.*	
Molybdate of potaſh. *Molybdas potaſſæ.*	
Molybdate of ſoda. *Molybdas ſodæ.*	
Molybdate of tungſten. *Molybdas tunſteni.*	
Molybdate of zinc. *Molybdas zinci.*	
Molybdena.	*Regulus of molybdena.*
Mucus.	*Mucilage.*
Muriate. *Murias, tis, ſ. m.*	Salt formed by the union of the muriatic acid with different baſes
Muriate of alumine. *Murias aluminoſus.*	*Marine alum.* *Argillaceous marine ſalt.*
Muriate of ammoniac. *Murias ammoniacalis.*	*Sal ammoniac.* *Salmiac.*
Muriate of antimony. *Murias ſtibii.*	*Muriate of antimony.*

M

New Names.	Old Names.
Muriate, fuming, of antimony. *Murias ſtibii fumans.*	*Butter of antimony.*
Muriate of ſilver. *Murias argenti.*	*Corneous ſilver.* *Luna cornea.*
Muriate of arſenic. *Murias arſenicalis.*	
Muriate, ſublimated, of arſenic. *Murias arſenicalis ſublimatus.*	*Butter of arſenic.*
Muriate of barytes. *Murias baryticus.*	*Barotic marine ſalt.*
Muriate of biſmuth. *Murias biſmuthi.*	*Muriate of biſmuth.*
Muriate, ſublimated, of biſmuth. *Murias biſmuthi ſublimatus.*	*Butter of biſmuth.*
Muriate of lime. *Murias calcareus.*	*Mother water of marine ſalt.* *Calcareous marine ſalt.* *Fixed ſal ammoniac.*
Muriate of cobalt. *Murias cobalti.*	*Ink of ſympathy.*
Muriate of copper. *Murias cupri.*	*Muriate of copper.*
Muriate, ſublimated ammoniacal of copper. *Murias cupri ammoniacalis ſublimatus.*	*Cupreous ammoniacal flowers.*
Muriate of tin. *Murias ſtanni.*	*Salt of Jupiter.*
Muriate, concrete, of tin. *Murias ſtanni concretus.*	*Solid butter of tin of M. Baumé.* *Corneous tin.*
Muriate, fuming, of tin. *Murias ſtanni fumans.*	*Fuming liquor of Libavius.*
Muriate, ſublimated, of tin. *Murias ſtanni ſublimatus.*	*Butter of tin.*
Muriate of iron. *Murias ferri.*	*Muriate of iron.* *Marine ſalt of iron.*

New Names.	M	Old Names.
Muriate, ſublimated ammoniacal, of iron. *Murias ferri ammoniacalis ſublimatus.*		*Martial ammoniacal flowers.*
Muriate of magneſia. *Murias magneſiæ.*		*Marine ſalt with a baſe of magneſia.*
Mutiate of manganeſe. *Murias magneſii.*		*Muriate of manganeſe.*
Muriate, corroſive, of mercury. *Murias hydrargyri corroſivus.*		*Corroſive ſublimate.*
Muriate, ſweet, of mercury. *Murias hydrargyri dulcis.*		*Sweet ſublimate.*
Muriate, ſweet ſublimated, of mercury. *Murias hydrargyri ſublimatus.*		*Aquila alba.*
Muriate of mercury and ammoniac. *Murias hydrargyri et ammoniacalis.*		*Sal alembroth.*
Muriate of mercury by precipitation. *Murias hydrargyri præcipitatus.*		*Salt of wiſdom.* *White precipitated muriate.*
Muriate of molybdena. *Murias molybdeni.*		
Muriate of nickel. *Murias niccoli.*		
Muriate of gold. *Murias auri.*		*Muriate of gold.* *Regaline ſalt of gold.*
Muriate of platina. *Murias platini.*		*Muriate of platina.* *Regaline ſalt of platina.*
Muriate of lead. *Murias plumbi.*		*Corneous lead.* *Muriate of lead.*
Muriate of potaſh. *Murias potaſſæ.*		*Febrifuge ſalt of Sylvius.*
Muriate of ſoda. *Murias ſodæ.*		*Marine ſalt.*

M

New Names.	Old Names.
Muriate, foſſil, of ſoda. *Murias ſodæ foſſilis.*	*Sal gem.*
Muriate of tungſten. *Murias tunſteni.*	
Muriate of zinc. *Murias zinci.*	*Marine ſalt of zinc.* *Muriate of zinc.*
Muriate, ſublimated, of zinc. *Murias zinci ſublimatus.*	*Butter of zinc.*
Muriates, oxigenated.	New combinations of the oxigenated muriatic acid with potaſh and ſoda, diſcovered by M. Berthollet.
Muriate, oxigenated, of potaſh. *Murias oxigenatus potaſſæ.*	
Muriate, oxigenated, of ſoda. *Murias oxigenatus ſodæ.*	

N

Nitrate. *Nitras, tis. ſ. m.*	Salts formed by the combination of the nitric acid with different baſes.
Nitrate of alumine. *Nitras aluminoſus.*	*Nitrous alum.* *Argillaceous nitre.*
Nitrate of ammoniac. *Nitras ammoniacalis.*	*Ammoniacal nitrous ſalt.* *Ammoniacal nitre.*
Nitrate of antimony. *Nitras ſtibii.*	
Nitrate of ſilver. *Nitras argenti.*	*Lunar nitre.* *Nitre of ſilver.* *Cryſtals of the moon.*
Nitrate, melted, of ſilver. *Nitras argenti fuſus.*	*Infernal ſtone.*
Nitrate of arſenic. *Nitras arſenicalis.*	*Nitre of arſenic.*

N

New Names.	Old Names.
Nitrate of barytes. *Nitras baryticus.*	*Nitre of ponderous earth.* *Barotic nitre.*
Nitrate of biſmuth. *Nitras biſmuthi.*	*Nitre of biſmuth.*
Nitrate of lime. *Nitras calcareus.*	*Calcareous nitre.* *Mother water of nitre.*
Nitrate of cobalt. *Nitras cobalti.*	*Nitre of cobalt.*
Nitrate of copper. *Nitras cupri.*	*Nitrate of copper.*
Nitrate of tin. *Nitras ſtanni.*	*Nitre of tin.* *Stanno-nitrous ſalt.*
Nitrate of iron. *Nitras ferri.*	*Nitre of iron.* *Martial nitre.*
Nitrate of magneſia. *Nitras magneſiæ.*	*Nitre of magneſia.* *Magneſian nitre.*
Nitrate of manganeſe. *Nitras magneſii.*	*Nitre of manganeſe.*
Nitrate of mercury. *Nitras hydrargyri.*	*Mercurial nitre.* *Nitre of mercury.*
Nitrate of mercury in a ſtate of ſolution. *Nitras hydrargyri ſolutus.*	*Mercurial water.*
Nitrate of molybdena. *Nitras molybdeni.*	
Nitrate of nickel. *Nitras niccoli.*	*Nitre of nickel.*
Nitrate of gold. *Nitras auri.*	
Nitrate of platina. *Nitras platini.*	
Nitrate of lead. *Nitras plumbi.*	*Nitre of lead.* *Saturnine nitre*
Nitrate of potaſh, *or* nitre. *Nitras potaſſæ,* vel *nitrum.*	*Nitre.* *Saltpetre.*

N

New Names.	Old Names.
Nitrate of ſoda. *Nitras ſodæ.*	*Cubic nitre.* *Rhomboidal nitre.*
Nitrate of tungſten. *Nitras tunſteni.*	
Nitrate of zinc. *Nitras zinci.*	*Nitre of zinc.*
Nitrite. *Nitris, tis. ſ. m.*	Salt formed by the combination of the *nitrous* * acid with different baſes. This genus of ſalts had no name in the old Nomenclature, being unknown before the late diſcoveries.
Nitrite of alumine. *Nitris aluminoſus.*	
Nitrite of ammoniac. *Nitris ammoniacalis.*	
Nitrite of antimony. *Nitris ſtibii.*	
Nitrite of ſilver. *Nitris argenti.*	
Nitrite of arſenic. *Nitris arſenicalis.*	
Nitrite of barytes. *Nitris baryticus.*	
Nitrite of biſmuth. *Nitris biſmuthi.*	
Nitrite of lime. *Nitris calcareus.*	
Nitrite of cobalt. *Nitris cobalti.*	
Nitrite of copper. *Nitris cupri.*	
Nitrite of tin. *Nitris ſtanni.*	

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* That is, with ſpirit of nitre containing leſs oxigene than *nitric* acid, which forms *nitrates*.

N

New Names.	*Old Names.*
Nitrite of iron. *Nitris ferri.*	
Nitrite of magneſia. *Nitris magneſiæ.*	
Nitrite of manganeſe. *Nitris magneſii.*	
Nitrite of mercury. *Nitris hydrargyri.*	
Nitrite of molybdena. *Nitris molybdeni.*	
Nitrite of nickel. *Nitris niccoli.*	
Nitrite of gold. *Nitris auri.*	
Nitrite of platina. *Nitris platini.*	
Nitrite of lead. *Nitris plumbi.*	
Nitrite of potaſh. *Nitris potaſſæ.*	
Nitrite of ſoda. *Nitris ſodæ.*	
Nitrite of tungſten. *Nitris tunſteni.*	
Nitrite of zinc. *Nitris zinci.*	

O

New Names.	*Old Names.*
Oils, empyreumatic. *Olea empyreumatica.*	*Empyreumatic oils.*
Oils, fixed. *Olea fixa.*	*Fat oils.* *Sweet oils.* *Oils obtained by expreſſion.*
Oils, volatile. *Olea volatilia.*	*Eſſential oils.* *Eſſences.*

N

New Names.	Old Names.
Oxalate. *Oxalas, tis. ſ. m.*	Salt formed by the combination of the oxalic acid with different baſes. Scarce any of the ſalts of this genus had a name in the old Nomenclature.
Oxalate, acidulous, of ammoniac. *Oxalas acidulus ammoniacalis.*	
Oxalate, acidulous, of potaſh. *Oxalas acidulus potaſſæ.*	*Salt of ſorrel of commerce.*
Oxalate, acidulous, of ſoda. *Oxalas acidulus ſodæ.*	
Oxalate of alumine. *Oxalas aluminoſus.*	
Oxalate of ammoniac. *Oxalas ammoniacalis.*	
Oxalate of antimony. *Oxalas ſtibii.*	
Oxalate of ſilver. *Oxalas argenti.*	
Oxalate of arſenic. *Oxalas arſenicalis.*	
Oxalate of barytes. *Oxalas baryticus.*	
Oxalate of biſmuth. *Oxalas biſmuthi.*	
Oxalate of lime. *Oxalas calcareus.*	
Oxalate of cobalt. *Oxalas cobalti.*	
Oxalate of copper. *Oxalas cupri.*	
Oxalate of tin. *Oxalas ſtanni.*	
Oxalate of iron. *Oxalas ferri.*	
Oxalate of magneſia. *Oxalas magneſiæ.*	

C

New Names.	**Old Names.**
Oxalate of manganeſe. *Oxalas magneſii.*	
Oxalate of mercury. *Oxalas hydrargyri.*	
Oxalate of molybdena. *Oxalas molybdeni.*	
Oxalate of nickel. *Oxalas niccoli.*	
Oxalate of gold. *Oxalas auri.*	
Oxalate of platina. *Oxalas platini.*	
Oxalate of lead. *Oxalas plumbi.*	
Oxalate of potaſh. *Oxalas potaſſæ.*	
Oxalate of ſoda. *Oxalas ſodæ.*	
Oxalate of tungſten. *Oxalas tunſteni.*	
Oxalate of zinc. *Oxalas zinci.*	
Oxide, arſenical, of potaſh. *Oxidum arſenicale potaſſæ.*	*Liver of arſenic.*
Oxide, white, of arſenic. *Oxidum arſenici album.*	*White arſenic.* *Calx of arſenic.*
Oxide of antimony, BY THE MURIATIC AND NITRIC ACIDS. *Oxidum ſtibii acidis muriatico et nitrico confectum.*	*Mineral bezoar.*
Oxide of antimony, white, by nitre. *Oxidum ſtibii album nitro contectum*	*Diaphoretic antimony.* *Ceruſe of antimony.* *Materia perlata of Kerkringius.*
Oxide, white ſublimated, of antimony. *Oxidum ſtibii album ſublimatum.*	*Snow of antimony* *Flowers of antimony.* *Silver flowers of regulus of antimony.*

O

New Names.	Old Names.
Oxide of antimony, by the muriatic acid. *Oxidum ſtibii acido muriatico confectum.*	*Powder of Algaroth.*
Oxide, ſulphurated, of antimony. *Oxidum ſtibii ſulphuratum.*	*Liver of antimony.*
Oxide, ſulphurated ſemi-vitreous, of antimony. *Oxidum ſtibii ſulphuratum ſemi-vitreum.*	*Saffron of metals.*
Oxide, orange-coloured ſulphurated, of antimony. *Oxidum ſtibii ſulphuratum aurantiacum.*	*Gilded ſulphur of antimony.*
Oxide, red ſulphurated, of antimony. *Oxidum ſtibii ſulphuratum rubrum.*	*Kermes mineral.*
Oxide, vitreous ſulphurated, of antimony. *Oxidum ſtibii ſulphuratum vitreum.*	*Glaſs of antimony.*
Oxide, brown vitreous ſulphurated, of antimony. *Oxidum ſtibii ſulphuratum vitreum fuſcum.*	*Rubine of antimony.*
Oxide, white ſublimated, of arſenic. *Oxidum arſenici album ſublimatum.*	*Flowers of arſenic.*
Oxide, yellow ſulphurated, of arſenic. *Oxidum arſenici ſulphuratum luteum.*	*Orpiment.*
Oxide, red ſulphurated, of arſenic. *Oxidum arſenici ſulphuratum rubrum.*	*Red arſenic.* *Realgar,* or *realgal.*

O

New Names.	Old Names.
Oxide, white, of biſmuth, by the nitric acid. *Oxidum biſmuthi album acido nitrico confectum.*	*Magiſtery of biſmuth.* *White paint.*
Oxide, ſublimated, of biſmuth. *Oxidum biſmuthi ſublimatum.*	*Flowers of biſmuth.*
Oxide, grey, of cobalt with ſilex, *or* zaffre. *Oxidum cobalti cinereum cum ſilice.*	*Zaffre.*
Oxide, vitreous, of cobalt. *Oxidum cobalti vitreum.*	*Azure.* *Smalt.*
Oxide, green acetated, of copper. *Oxidum cupri viride acetatum.*	*Verdigriſe.* *Ruſt of copper.*
Oxide, grey, of tin. *Oxidum ſtanni cinereum.*	*Putty of tin.*
Oxide, ſublimated, of tin. *Oxidum ſtanni ſublimatum.*	*Flowers of tin.*
Oxides of iron. *Oxida ferri.*	*Saffrons of Mars.*
Oxide, brown, of iron. *Oxidum ferri ſuſcum.*	*Aſtringent ſaffron of Mars.*
Oxide, yellow, of iron. *Oxidum ferri luteum.*	*Ochre.*
Oxide, black, of iron. *Oxidum ferri nigrum.*	*Martial Ethiops.*
Oxide, red, of iron. *Oxidum ferri rubrum.*	*Colcothar.*
Oxide, white, of manganeſe. *Oxidum magneſii album.*	*White calx of manganeſe.*
Oxide, black, of manganeſe. *Oxidum magneſii nigrum.*	*Black magneſia.* *Glaſs-makers ſoap.* *Stone of Perigueux.*
Oxide, yellow, of mercury, by the nitric acid. *Oxidum hydrargyri luteum acido nitrico confectum.*	*Nitrous turbith.*

B

New Names.	Old Names.
Oxide, yellow, of mercury by the ſulphuric acid. *Oxidum hydrargyri luteum acido ſulphurico confectum.*	*Mineral turbith.* *Yellow precipitate.*
Oxide, blackiſh, of mercury. *Oxidum hydrargyri nigrum.*	*Ethiops* per ſe.
Oxide, red, of mercury by the nitric acid. *Oxidum hydrargyri rubrum. acido nitrico confectum.*	*Red precipitate.*
Oxide, red, of mercury by fire. *Oxidum hydrargyri rubrum per ignem.*	*Precipitate* per ſe.
Oxide, black ſulphurated, of mercury. *Oxidum hydrargyri ſulphuratum nigrum.*	*Mineral ethiops.*
Oxide, red ſulphurated, of mercury. *Oxidum hydrargyri ſulphuratum rubrum.*	*Cinnabar.*
Oxide, ammoniacal, of gold. *Oxidum auri ammoniacale.*	*Fulminating gold.*
Oxide of gold by tin. *Oxidum auri per ſtannum.*	*Precipitate of gold by tin.* *Purple of Caſſius.*
Oxides of lead. *Oxida plumbi.*	*Calces of lead.*
Oxide, white, of lead by the acetous acid. *Oxidum plumbi album per acidum acetoſum.*	*White of lead.*
Oxide, ſemi-vitreous, of lead, *or* litharge. *Oxidum plumbi ſemi-vitreum.*	*Litharge.*
Oxide, yellow, of lead. *Oxidum plumbi luteum.*	*Maſſicot.*
Oxide, red, of lead, *or* minium. *Oxidum plumbi rubrum.*	*Minium.*

S

New Names.	Old Names.
Oxide, ſublimated, of zinc. *Oxidum zinci ſublimatum.*	*Philoſophic wool.* *Philoſophic cotton.* *Flowers of zinc.* *Pompholyx.*
Oxides, metallic. *Oxida metallica.*	*Metallic calces.*
Oxides, metallic ſublimated. *Oxida metallica ſublimata.*	*Metallic flowers.*
Oxygene. *Oxygenium.*	*Oxygene.* *Baſe of vital air.* *Acidifying principle.* *Empyreal air.* *Principium ſorbile.*

P

Phoſphate. *Phoſphas, tis. ſ. m.*	Salt formed by the union of the phoſphoric acid with different baſes.
Phoſphate of alumine. *Phoſphas aluminoſus.*	
Phoſphate of ammoniac. *Phoſphas ammoniacalis.*	*Phoſphoric ammoniac.* *Ammoniacal phoſphate.*
Phoſphate of antimony. *Phoſphas ſtibii.*	
Phoſphate of ſilver. *Phoſphas argenti.*	
Phoſphate of arſenic. *Phoſphas arſenicalis.*	
Phoſphate of barytes. *Phoſphas baryticus.*	
Phoſphate of biſmuth. *Phoſphas biſmuthi.*	
Phoſphate, calcareous, or of lime. *Phoſphas calcareus.*	*Earth of bones.* *Calcareous phoſphate.* *Animal earth.*

C

New Names.	Old Names.
Phoſphate of cobalt. *Phoſphas cobalti.*	
Phoſphate of copper. *Phoſphas cupri.*	
Phoſphate of tin. *Phoſphas ſtanni.*	
Phoſphate of iron. *Phoſphas ferri.*	*Syderite.* *Iron of water.* *Ore of iron from marſhes.*
Phoſphate of magneſia. *Phoſphas magneſiæ.*	*Phoſphate of magneſia.*
Phoſphate of manganeſe. *Phoſphas magneſii.*	
Phoſphate of mercury. *Phoſphas hydrargyri.*	*Roſe precipitate of Lemery.*
Phoſphate of molybdena. *Phoſphas molybdeni.*	
Phoſphate of nickel. *Phoſphas niccoli.*	
Phoſphate of gold. *Phoſphas auri.*	
Phoſphate of platina. *Phoſphas platini.*	
Phoſphate of lead. *Phoſphas plumbi.*	
Phoſphate of potaſh. *Phoſphas potaſſæ.*	
Phoſphate of ſoda. *Phoſphas ſodæ.*	
Phoſphate of ſoda and ammoniac. *Phoſphas ſodæ et ammoniacalis.*	*Native ſalt of urine.* *Fuſible ſalts of urine.*
Phoſphate, ſuperſaturated, of ſoda. *Phoſphas ſuperſaturatus ſodæ.*	*Sal admirabile perlatum.*

New Names.	P	Old Names.
Phoſphate of tungſten. *Phoſphas tunſteni.*		
Phoſphate of zinc. *Phoſphas zinci.*		
Phoſphite. *Phoſphis, tis. ſ. m.*		Salt formed by the union of the phoſphorous acid with different baſes.
Phoſphite of alumine. *Phoſphis aluminoſus.*		
Phoſphite of ammoniac. *Phoſphis ammoniacalis.*		
Phoſphite antimony. *Phoſphis ſtibii.*		
Phoſphite of ſilver. *Phoſphis argenti.*		
Phoſphite of arſenic. *Phoſphis arſenicalis.*		
Phoſphite of barytes. *Phoſphis baryticus.*		
Phoſphite of biſmuth. *Phoſphis biſmuthi.*		
Phoſphite of lime. *Phoſphis calcareus.*		
Phoſphite of cobalt. *Phoſphis cobalti.*		
Phoſphite of copper. *Phoſphis cupri.*		
Phoſphite of tin. *Phoſphis ſtanni.*		
Phoſphite of iron. *Phoſphis ferri.*		
Phoſphite of magneſia. *Phoſphis magneſiæ.*		
Phoſphite of manganeſe. *Phoſphis magneſii.*		
Phoſphite of mercury. *Phoſphis hydrargyri.*		

P

New Names.	Old Names.
Phoſphite of molybdena. *Phoſphis molybdeni.*	
Phoſphite of nickel. *Phoſphis niccoli.*	
Phoſphite of gold. *Phoſphis auri.*	
Phoſphite of platina. *Phoſphis platini.*	
Phoſphite of lead. *Phoſphis plumbi.*	
Phoſphite of potaſh. *Phoſphis potaſſæ.*	
Phoſphite of ſoda. *Phoſphis ſodæ.*	
Phoſphite of tungſten. *Phoſphis tunſteni.*	
Phoſphite of zinc. *Phoſphis zinci.*	
Phoſphorus. *Phoſphorum.*	*Phoſphorus of Kunckel.*
Phoſphure. *Phoſphoretum.*	Combination of non-oxigenated phoſphorus with different baſes.
Phoſphure of copper. *Phoſphoretum cupri.*	
Phoſphure of iron. *Phoſphoretum ferri.*	*Syderum of Bergman.* *Syderotete of M. de Morveau.* *Regulus of ſyderite.*
Pyro-lignite. *Pyro lignis, tis. ſ. m*	Salt formed by the union of the pyro-ligneous acid with different baſes. Theſe ſalts had no name in the old Nomenclature.
Pyro-lignite of alumine. *Pyro-lignis aluminoſus.*	
Pyro-lignite of ammoniac. *Pyro-lignis ammoniacalis.*	

New Names. P New Names.

Pyro-lignite of antimony.
  Pyro-lignis ſtibii.
Pyro-lignite of ſilver.
  Pyro-lignis argenti.
Pyro-lignite of arſenic.
  Pyro-lignis arſenicalis.
Pyro-lignite of barytes.
  Pyro lignis baryticus.
Pyro-lignite of biſmuth.
  Pyro-lignis biſmuthi.
Pyro-lignite of lime.
  Pyro lignis calcareus.
Pyro-lignite of cobalt.
  Pyro-lignis cobalti.
Pyro-lignite of copper.
  Pyro lignis cupri.
Pyro-lignite of tin.
  Pyro lignis ſtanni.
Pyro-lignite of iron.
  Pyro-lignis ferri.
Pyro-lignite of magneſia.
  Pyro-lignis magneſiæ.
Pyro-lignite of manganeſe.
  Pyro lignis magneſii.
Pyro-lignite of mercury.
  Pyro-lignis hydrargyri.
Pyro-lignite of molybdena.
  Pyro-lignis molybdeni.
Pyro-lignite of nickel.
  Pyro-lignis niccoli.
Pyro-lignite of gold.
  Pyro-lignis auri.
Pyro-lignite of platina.
  Pyro-lignis platini.
Pyro-lignite of lead.
  Pyro-lignis plumbi.
Pyro-lignite of potaſh.
  Pyro-lignis potaſſæ.

P

New Names.	Old Names.
Pyro-lignite of ſoda. *Pyro lignis ſodæ.*	
Pyro-lignite of tungſten. *Pyro-lignis tunſteni.*	
Pyro-lignite of zinc. *Pyro-lignis zinci.*	
Pyro-mucites. *Pyro-mucis.*	Salts formed by the union of the pyro-mucous acid with different baſes. This ſpecies of ſalts has not yet obtained a name in the old Nomenclature.
Pyro-mucite of alumine. *Pyro-mucis aluminoſus.*	
Pyro-mucite of ammoniac. *Pyro-mucis ammoniacalis.*	
Pyro-mucite of antimony. *Pyro-mucis ſtibii.*	
Pyro-mucite of ſilver. *Pyro-mucis argenti.*	
Pyro-mucite of arſenic. *Pyro-mucis arſenicalis.*	
Pyro-mucite of barytes. *Pyro-mucis baryticus.*	
Pyro-mucite of biſmuth. *Pyro-mucis biſmuthi.*	
Pyro-mucite of lime. *Pyro-mucis calcareus.*	
Pyro-mucite of cobalt. *Pyro-mucis cobalti.*	
Pyro-mucite of copper. *Pyro-mucite of copper.*	
Pyro-mucite of tin. *Pyro-mucis ſtanni.*	
Pyro-mucite of iron. *Pyro-mucis ferri.*	

New Names.	P	Old Names.
Pyro-mucite of magneſia. *Pyro-mucis magneſiæ.*		
Pyro-mucite of mangeneſe. *Pyro-mucis magneſii.*		
Pyro-mucite of mercury. *Pyro-mucis hydrargyri.*		
Pyro-mucite of molybdena. *Pyro-mucis molybdeni.*		
Pyro-mucite of nickel. *Pyro-mucis niccoli.*		
Pyro-mucite of gold. *Pyro-mucis auri.*		
Pyro-mucite of platina. *Pyro-mucis platini.*		
Pyro-mucite of lead. *Pyro-mucis plumbi.*		
Pyro-mucite of potaſh. *Pyro-mucis potaſſæ.*		
Pyro-mucite of ſoda. *Pyro-mucis ſodæ.*		
Pyro-mucite of tungſten. *Pyro-mucis tunſteni.*		
Pyro-mucite of zinc. *Pyro-mucis zinci.*		
Pyro-tartarites. *Pyro-tartaris, tis. ſ. m.*		Salts formed by the union of the pyro-tartareous acid with different baſes.
Pyro-tartarite of alumine. *Pyro-tartaris aluminoſus.*		
Pyro-tartarite of ammoniac. *Pyro-tartaris ammoniacalis.*		
Pyro-tartarite of antimony. *Pyro-tartaris ſtibii.*		
Pyro-tartarite of ſilver. *Pyro-tartaris argenti.*		
Pyro-tartarite of arſenic. *Pyro-tartaris arſenicalis.*		

P

New Names.	Old Names.
Pyro-tartarite of barytes. *Pyro-tartaris baryticus.*	
Pyro-tartarite of biſmuth. *Pyro-tartaris biſmuthi.*	
Pyro-tartarite of lime. *Pyro-tartaris calcareus.*	
Pyro-tartarite of cobalt. *Pyro-tartaris cobalti.*	
Pyro-tartarite of copper. *Pyro-tartaris cupri.*	
Pyro-tartarite of tin. *Pyro-tartaris ſtanni.*	
Pyro-tartarite of iron. *Pyro-tartaris ferri.*	
Pyro-tartarite of magneſia. *Pyro tartaris magneſiæ.*	
Pyro-tartarite of manganeſe. *Pyro-tartaris magneſii.*	
Pyro tartarite of mercury. *Pyro-tartaris hydrargyri.*	
Pyro-tartarite of molybdena. *Pyro-tartaris molybdeni.*	
Pyro-tartarite of nickel. *Pyro tartaris niccoli.*	
Pyro-tartarite of gold. *Pyro-tartaris auri.*	
Pyro-tartarite of platina. *Pyro-tartaris platini.*	
Pyro-tartarite of lead. *Pyro tartaris plumbi.*	
Pyro-tartarite of potaſh. *Pyro-tartaris potaſſæ.*	
Pyro tartarite of ſoda. *Pyro tartaris ſodæ.*	
Pyro-tartarite of tungſten. *Pyro-tartaris tunſteni.*	
Pyro tartarite of zinc. *Pyro tartaris zinci.*	

P

New Names.	Old Names.
Platina. *Platinum.*	*Juan blanca.* *Platina.* *Platina del pinto.*
Potaſh. *Potaſſa, æ.*	*Vegetable cauſtic fixed alkali.*
Potaſh, melted. *Potaſſa fuſa.*	*Lapis cauſticus.*
Potaſh, ſiliceous fluid. *Potaſſa ſilicea fluida.*	*Liquor of ſlints.*
Pruſſiate. *Pruſſias, tis. ſ. m.*	Salts formed by the union of the Pruſſic acid, or colouring matter of Pruſſian blue, with different baſes. This genus of ſalts had no name in the old Nomenclature.
Pruſſiate of alumine. *Pruſſias aluminoſus.*	
Pruſſiate of ammoniac. *Pruſſias ammoniacalis.*	
Pruſſiate of antimony. *Pruſſias ſtibii.*	
Pruſſiate of ſilver. *Pruſſias argenti.*	
Pruſſiate of arſenic. *Pruſſias arſenicalis.*	
Pruſſiate of barytes. *Pruſſias baryticus.*	
Pruſſiate of biſmuth. *Pruſſias biſmuthi.*	
Pruſſiate of lime. *Pruſſias calcareus.*	*Calcareous pruſſiate.* *Pruſſian lime-water.*
Pruſſiate of cobalt. *Pruſſias cobalti.*	
Pruſſiate of copper. *Pruſſias cupri.*	
Pruſſiate of tin. *Pruſſias ſtanni.*	

P

New Names.	Old Names.
Pruſſiate of iron. *Pruſſias ferri.*	*Pruſſian blue.* *Berlin blue.*
Pruſſiate of magneſia. *Pruſſias magneſiæ.*	
Pruſſiate of manganeſe. *Pruſſias magneſii.*	
Pruſſiate of mercury. *Pruſſias hydrargyri.*	
Pruſſiate of molybdena. *Pruſſias molybdeni.*	
Pruſſiate of nickel. *Pruſſias niccoli.*	
Pruſſiate of gold. *Pruſſias auri.*	
Pruſſiate of platina. *Pruſſias platini.*	
Pruſſiate of lead. *Pruſſias plumbi.*	
Pruſſiate of potaſh. *Pruſſias potaſſæ.*	*Liquor ſaturated with the colouring part of Pruſſian blue.*
Pruſſiate, ferruginous ſaturated, of potaſh. *Pruſſias potaſſæ ferruginoſus ſaturatus.*	*Pruſſian alkali.*
Pruſſiate, ferruginous, not ſaturated, of potaſh. *Pruſſias potaſſæ ferruginoſus non ſaturatus.*	*Phlogiſticated alkali.*
Pruſſiate of ſoda. *Pruſſias ſodæ.*	
Pyrophorus of Homberg. *Pyrophorum Hombergii.*	*Pyrophorus of Homberg.*

R

Reſins. *Reſinæ.*	*Reſins.*

S

New Names.	Old Names.
Saccho-late. *Saccholas, tis. ſ. m.*	Salts formed by the union of the ſaccho-lactic acid with different baſes. This ſpecies of ſalts has no name in the old Nomenclature.
Saccho-late of alumine. *Saccholas aluminoſus.*	
Saccho-late of ammoniac. *Saccholas ammoniacalis.*	
Saccho-late of antimony. *Saccholas ſtibii.*	
Saccho-late of ſulphur. *Saccholas argenti.*	
Saccho-late of arſenic. *Saccholas arſenicalis.*	
Saccho-late of barytes. *Saccholas baryticus.*	
Saccho-late of biſmuth. *Saccholas biſmuthi.*	
Saccho-late of lime. *Saccholas calcareus.*	
Saccho-late of cobalt. *Saccholas cobalti.*	
Saccho-late of copper. *Saccholas cupri.*	
Saccho-late of tin. *Saccholas ſtanni.*	
Saccho-late of iron. *Saccholas ferri.*	
Saccho-late of magneſia. *Saccholas magneſiæ.*	
Saccho-late of manganeſe. *Saccholas magneſii.*	
Saccho-late of mercury. *Saccholas hydrargyri.*	

S

New Names.	Old Names.
Saccho-late of molybdena. *Saccholas molybdeni.*	
Saccho-late of nickel. *Saccholas niccoli.*	
Saccho-late of gold. *Saccholas auri.*	
Saccho-late of platina. *Saccholas platini.*	
Saccho-late of lead. *Saccholas plumbi.*	
Saccho-late of potaſh. *Saccholas potaſſæ.*	
Saccho-late of ſoda. *Saccholas ſodæ.*	
Saccho-late of tungſten. *Saccholas tunſteni.*	
Saccho-late of zinc. *Saccholas zinci.*	
Saponulæ. *Saponuli.*	Combinations of volatile or eſſential oils with different baſes.
Saponulæ, acid. *Saponuli acidi.*	Combinations of volatile or eſſential oils with different acids.
Saponula of alumine. *Saponulus aluminoſus.*	Soap compoſed of volatile oil, combined with the baſe of alum.
Saponula, ammoniacal. *Saponulus ammoniacalis.*	Soap compoſed of volatile oil, combined with ammoniac.
Saponula of barytes. *Saponulus barytæ.*	Soap compoſed of volatile oil, combined with barytes.
Saponula of lime. *Saponulus calcareus.*	Soap compoſed of volatile oil, combined with lime.
Saponula of potaſh. *Saponulus potaſſa.*	Soap compoſed of volatile oil, combined with potaſh, or *ſoap of Starkey.*
Saponulæ of ſoda. *Saponuli ſodæ.*	Soaps compoſed of volatile oils, combined with fixed mineral alkali, or ſoda.
Saponulæ, metallic. *Saponuli metallici.*	Soaps compoſed of volatile oils, united to metallic ſubſtances.

S

New Names.	Old Names.
Sebate. *Sebas, tis. ſ. m.*	Salts formed by the union of the acid of greaſe, or the ſebacic acid, with different baſes. Theſe ſalts have no name in the ancient Nomenclature.
Sebate of alumine. *Sebas aluminoſus.*	
Sebate of ammoniac. *Sebas ammonicalis.*	
Sebate of antimony. *Sebas ſtibii.*	
Sebate of ſilver. *Sebas argenti.*	
Sebate of arſenic. *Sebas arſenicalis.*	
Sebate of barytes. *Sebas baryticus.*	
Sebate of biſmuth. *Sebas biſmuthi.*	
Sebate of lime. *Sebas calcareus.*	
Sebate of cobalt. *Sebas cobalti.*	
Sebate of copper. *Sebas cupri.*	
Sebate of tin. *Sebas ſtanni.*	
Sebate of iron. *Sebas ferri.*	
Sebate of magneſia. *Sebas magneſiæ.*	
Sebate of mangaueſe. *Sebas magneſii.*	
Sebate of mercury. *Sebas hydrargyri.*	
Sebate of molybdena. *Sebas molybdeni.*	

S

New Names.	Old Names.
Sebate of nickel. *Sebas niccoli.*	
Sebate of gold. *Sebas auri.*	
Sebate of platina. *Sebas platini.*	
Sebate of lead. *Sebas plumbi.*	
Sebate of potaſh. *Sebas potaſſæ.*	
Sebate of ſoda. *Sebas ſodæ.*	
Sebate of tungſten. *Sebas tunſteni.*	
Sebate of zinc. *Sebas zinci.*	
Semi-metals.	*Semi-metals.*
Silex, *or* ſiliceous earth. *Silica, terra ſilicea.*	*Quartzoſe earth.* *Siliceous earth.* *Vitrifiable earth.*
Silver. *Argentum.*	*Diana.* *Luna.* *Silver.*
Soaps. *Sapones.*	Combinations of fat or fixed oils with different baſes.
Soaps, acid. *Sapones acidi.*	Combinations of fat or fixed oils with different acids.
Soap of alumine. *Sapo aluminoſus.*	Soap compoſed of fixed oil, combined with alumine.
Soap, ammoniacal. *Sapo ammoniacalis.*	Soap compoſed of fixed oil, combined with volatile alkali.
Soap of barytes. *Sapo baryticus.*	Soap compoſed of fixed oil, combined with barytes.
Soap of lime. *Sapo calcareus.*	Soap compoſed of fixed oil, combined with lime.
Soap of magneſia. *Sapo magneſiæ.*	Soap compoſed of fixed oil, combined with magneſia.

S

New Names.	Old Names.
Soap of potaſh. *Sapo potaſſæ.*	Soap compoſed of fixed oil, combined with fixed vegetable alkali.
Soap of ſoda. *Sapo ſodæ.*	Soap compoſed of fixed oil, combined with fixed mineral alkali.
Soaps, metallic. *Sapones metallici.*	Combinations of fat or fixed oils with metallic ſubſtances.
Soda. *Soda.*	*Cauſtic ſoda.* *Marine alkali.* *Mineral alkali.*
Starch. *Amylum.*	*Starch.*
Steel. *Chalybs.*	*Steel.*
Succinate. *Succinas, tis. ſ. m.*	Salts formed by the combination of the ſuccinic acid with different baſes.
Succinate of alumine. *Succinas aluminoſus.*	
Succinate of ammoniac. *Succinas ammoniacalis.*	
Succinate of antimony. *Succinas ſtibii.*	
Succinate of arſenic. *Succinas arſenicalis.*	
Succinate of barytes. *Succinas baryticus.*	
Succinate of biſmuth. *Succinas biſmuthi.*	
Succinate of lime. *Succinas calcareus.*	
Succinate of cobalt. *Succinas cobalti.*	
Succinate of copper. *Succinas cupri.*	
Succinate of tin. *Succinas ſtanni.*	
Succinate of iron. *Succinas ferri.*	

S

New Names.	Old Names.
Succinate of magneſia. *Succinas magneſiæ.*	
Succinate of manganeſe. *Succinas magneſii.*	
Succinate of mercury. *Succinas hydrargyri.*	
Succinate of molybdena. *Succinas molybdeni.*	
Succinate of nickel. *Succinas niccoli.*	
Succinate of gold. *Succinas auri.*	
Succinate of platina. *Succinas platini.*	
Succinate of lead. *Succinas plumbi.*	
Succinate of potaſh. *Succinas potaſſæ.*	
Succinate of ſoda. *Succinas ſodæ.*	
Succinate of tungſten. *Succinas tunſteni.*	
Succinate of zinc. *Succinas zinci.*	
Succinum, or amber. *Succinum.*	*Karabeum.* *Yellow amber.* *Amber.*
Sugar. *Saccharum.*	*Sugar.*
Sugar, cryſtalliſed. *Saccharum cryſtalliſatum.*	*Sugar candy.*
Sugar of milk. *Saccharum lactis.*	*Sugar of milk.* *Salt of milk.*

S

New Names.	Old Names.
Sulphates. *Sulphas, tis. ſ. m.*	Salts formed by the combination of the ſulphuric acid with different baſes.
Sulphate of alumine. *Sulphas aluminoſus.*	*Alum.* *Argillaceous vitriol.*
Sulphate, ammoniacal. *Sulphas ammoniacalis.*	*Ammoniacal vitriolic ſalt.* *Ammoniacal ſalt (ſecret of Glauber's.)* *Ammoniacal vitriol.*
Sulphate of antimony. *Sulphas ſtibii.*	*Vitriol of antimony.*
Sulphate of ſilver. *Sulphas argenti.*	*Vitriol of ſilver.* *Vitriol of luna.*
Sulphate of arſenic. *Sulphas arſenicalis.*	*Vitriol of arſenic.*
Sulphate of barytes. *Sulphas baryticus.*	*Ponderous ſpar.* *Barotic vitriol.*
Sulphate of biſmuth. *Sulphas biſmuthi.*	*Vitriol of biſmuth.*
Sulphate of lime. *Sulphas calcareus.*	*Vitriol of lime.* *Calcareous vitriol.* *Selenite.* *Gypſum.*
Sulphate of cobalt. *Sulphas cobalti.*	*Vitriol of cobalt.*
Sulphate of copper. *Sulphas cupri.*	*Vitriol of Cyprus.* *Blue vitriol.* *Vitriol of copper, or of Venus.* *Blue copperas.*
Sulphate of tin. *Sulphas ſtanni.*	*Vitriol of tin.*
Sulphate of iron. *Sulphas ferri.*	*Martial vitriol.* *Green vitriol.* *Vitriol of iron.* *Green copperas.*

New Names.	N	Old Names.
Sulphate of magneſia. *Sulphas magneſiæ.*		*Magneſian vitriol.* *Bitter cathartic ſalt.* *Epſom ſalt.* *Salt* (de canal). *Salt of Seydſchutz.* *Salt of Sedlitz.*
Sulphate of manganeſe. *Sulphas magneſii.*		*Vitriol of manganeſe.*
Sulphate of mercury. *Sulphas hydrargyri.*		*Vitriol of mercury.*
Sulphate of molybdena. *Sulphas molybdeni.*		
Sulphate of nickel. *Sulphas niccoli.*		
Sulphate of gold. *Sulphas auri.*		
Sulphate of platina. *Sulphas platini.*		
Sulphate of lead. *Sulphas plumbi.*		*Vitriol of lead.*
Sulphate of potaſh. *Sulphas potaſſæ.*		*Vitriol of potaſh.* *Sal de duobus.* *Vitriolated tartar.* *Arcanum duplicatum.* *Sal polychreſt of Glaſer.*
Sulphate of ſoda. *Sulphas ſodæ.*		*Glauber's ſalt.* *Vitriol of ſoda.*
Sulphate of tungſten. *Sulphas tunſteni.*		
Sulphate of zinc. *Sulphas zinci.*		*Vitriol of zinc.* *White vitriol.* *Vitriol of Goſlar.* *White copperas.*
Sulphite. *Sulphis, tis.*		Salt formed by the combination of the ſulphureous acid with different baſes.

New Names.	N	*Old Names.*
Sulphite of alumine. *Sulphis aluminoſus.*		
Sulphite of ammoniac. *Sulphis ammoniacalis.*		
Sulphite of antimony. *Sulphis ſtibii.*		
Sulphite of ſilver. *Sulphis argenti.*		
Sulphite of arſenic. *Sulphis arſenicalis.*		
Sulphite of barytes. *Sulphis baryticus.*		
Sulphite of biſmuth. *Sulphis biſmuthi.*		
Sulphite of lime. *Sulphis calcareus.*		
Sulphite of cobalt. *Sulphis cobalti.*		
Sulphite of copper. *Sulphis cupri.*		
Sulphite of tin. *Sulphis ſtanni.*		
Sulphite of iron. *Sulphis ferri.*		
Sulphite of magneſia. *Sulphis magneſiæ.*		
Sulphite of manganeſe. *Sulphis magneſii.*		
Sulphite of mercury. *Sulphis hydrargyri.*		
Sulphite of molybdena. *Sulphis molybdenæ.*		
Sulphite of nickel. *Sulphis niccoli.*		

New Names.	Old Names.
	S
Sulphite of gold. *Sulphis auri.*	
Sulphite of platina. *Sulphis platini.*	
Sulphite of lead. *Sulphis plumbi.*	
Sulphite of potaſh. *Sulphis potaſſæ.*	*Sulphureous ſalt of Stahl.*
Sulphite of ſoda. *Sulphis ſodæ.*	
Sulphite of tungſten. *Sulphis tunſteni.*	
Sulphite of zinc. *Sulphis zinci.*	
Sulphur. *Sulphur.*	*Sulphur.*
Sulphur ſublimated. *Sulphur ſublimatum.*	*Flowers of ſulphur.*
Sulphures, alkaline. *Sulphureta alkalina.*	*Alkaline liver of ſulphur.* *Alkaline hepars.*
Sulphure of alumine. *Sulphuretum aluminæ.*	
Sulphure, ammoniacal. *Sulphuretum ammoniacale.*	*Fuming liquor of Boyle.* *Volatile alkaline liver of ſulphur.*
Sulphure of antimony. *Sulphuretum ſtibii.*	*Antimony.*
Sulphure, native, of antimony. *Sulphuretum ſtibii nativum.*	*Ore of antimony.*
Sulphure of ſilver. *Sulphuretum argenti.*	*Blanckmal.*
Sulphure of barytes. *Sulphuretum barytæ.*	*Barotic liver of ſulphur.*
Sulphure of biſmuth. *Sulphuretum biſmuthi.*	

S

New Names.	Old Names.
Sulphure, calcareous. *Sulphuretum calcareum.*	*Calcareous liver of ſulphur.*
Sulphure of cobalt. *Sulphureum cobalti.*	
Sulphure of copper. *Sulphuretum cupri.*	*Pyrites of copper.*
Sulphure of tin. *Sulphuretum ſtanni.*	
Sulphure of iron. *Sulphuretum ferri.*	*Martial pyrites.*
Sulphure of fixed oils. *Sulphuretum olei fixi.*	*Balſam of ſulphur.*
Sulphure of volatile oil. *Sulphuretum olei volatilis.*	*Balſam of ſulphur.*
Sulphure of magneſia. *Sulphuretum magneſiæ.*	*Liver of magneſian ſulphur.*
Sulphure of manganeſe. *Sulphuretum magneſii.*	
Sulphure of mercury. *Sulphuretum hydrargyri.*	
Sulphures, metallic. *Sulphureta metallica*	*Combinations of ſulphur with metals.*
Sulphure of molybdena. *Sulphuretum molybdeni.*	
Sulphure of nickel. *Sulphuretum niccoli.*	
Sulphure of gold. *Sulphuretum auri.*	
Sulphure of platina. *Sulphuretum platini.*	
Sulphure of lead. *Sulphuretum plumbi.*	
Sulphure of potaſh. *Sulphuretum potaſſæ.*	*Liver of ſulphur with a baſe of vegetable alkali.*

New Names.	S	Old Names.
Sulphure, antimoniated, of potaſh. *Sulphuretum potaſſæ ſtibiatum.*		*Antimoniated liver of ſulphur.*
Sulphure of ſoda. *Sulphuretum ſodæ.*		*Liver of ſulphur with a baſe of fixed mineral alkali.*
Sulphure, ammoniated, of ſoda. *Sulphuretum ſodæ ſtibiatum.*		*Ammoniated liver of ſulphur.*
Sulphure of tungſten. *Sulphuretum tunſteni.*		
Sulphure of zinc. *Sulphuretum zinci.*		*Blende,* or *falſe galena.*
Sulphures, earthy. *Sulphureta terrea.*		*Earthy livers of ſulphur.* *Earthy hepars.*

T

Tartar. *Tartarus.*	*Crude Tartar.*
Tartarite. *Tartaris, tis. ſ. m.*	Salt formed by the combination of the tartareous acid with different baſes.
Tartarite, acidulous, of potaſh. Tartareous acidulum of potaſh. *Tartaris acidulus potaſſæ.*	*Tartar.* *Cream of tartar.* *Cryſtals of tartar.*
Tartarite of alumine. *Tartaris aluminoſus.*	
Tartarite of ammoniac. *Tartaris ammoniacalis.*	*Ammoniacal tartar.* *Tartareous ammoniacal ſalt.*
Tartarite of antimony. *Tartaris ſtibii.*	

T

New Names.	Old Names.
Tartarite of ſilver. *Tartaris argenti.*	
Tartarite of arſenic. *Tartaris arſenicalis.*	
Tartarite of barytes. *Tartaris baryticus.*	
Tartarite of biſmuth. *Tartaris biſmuthi.*	
Tartarite of lime. *Tartaris calcareus.*	*Calcareous tartar.*
Tartarite of cobalt. *Tartaris cobalti.*	
Tartarite of copper. *Tartaris cupri.*	
Tartarite of tin. *Tartaris ſtanni.*	
Tartarite of iron. *Tartaris ferri.*	
Tartariſe of magneſia. *Tartaris magneſiæ.*	
Tartarite of manganeſe. *Tartaris magneſii.*	
Tartarite of mercury. *Tartaris hydrargyri.*	
Tartarite of molybdæna. *Tartaris molybdeni.*	
Tartarite of nickel. *Tartaris niccoli.*	
Tartarite of gold. *Tartaris auri.*	
Tartarite of platina. *Tartaris platini.*	

T

New Names.	Old Names.
Tartarite of lead. *Tartaris plumbi.*	*Saturnine tartar.*
Tartarite of potaſh. *Tartaris potaſſæ.*	*Soluble tartar.* *Tartarized tartar.* *Tartar of potaſh.* *Vegetable ſalt.*
Tartarite, ammoniated, of potaſh. *Tartaris potaſſæ ſtibiatus.*	*Stibiated tartar.* *Tartar emetic.* *Ammoniated tartar.* *Emetic.*
Tartarite, ferruginous, of potaſh. *Tartaris potaſſae ferrugineus.*	*Chalybeated tartar.* *Soluble martial tartar.*
Tartarite of potaſh, ſur-compounded of antimony. *Tartaris potaſſæ ſtibiatus.*	*Tartarized tartar, containing antimony.*
Tartarite of ſoda. *Tartaris ſodæ.*	*Tartar of ſoda.* *Polychreſt ſalt of Rochelle.* *Salt of Seignette.*
Tartarite of tungſten. *Tartaris tunſteni.*	
Tartarite of zinc. *Tartaris zinci.*	
Tin. *Stannum.*	*Tin.* *Jupiter.*
Tunſtate. *Tunſtas, tis. ſ. m.*	Salt formed by the combination of the tunſtic acid with different baſes. This genus of ſalt has no name in the old Nomenclature.
Tunſtate of alumine *Tunſtas aluminoſus.*	
Tunſtate of ammoniac. *Tunſtas ammoniacalis.*	
Tunſtate of antimony. *Tunſtas ſtibii.*	

New Names. T Old Names.

Tunſtate of ſilver.
Tunſtas argenti.
Tunſtate of arſenic.
Tunſtas arſenicalis.
Tunſtate of barytes.
Tunſtas baryticus.
Tunſtate of biſmuth.
Tunſtas biſmuthi.
Tunſtate of lime.
Tunſtas calcareus.
Tunſtate of cobalt.
Tunſtas cobalti.
Tunſtate of copper.
Tunſtas cupri.
Tunſtate of tin.
Tunſtas ſtanni.
Tunſtate of iron.
Tunſtas ferri.
Tunſtate of magneſia.
Tunſtas magneſiæ.
Tunſtate of manganeſe.
Tunſtas magneſii.
Tunſtate of mercury.
Tunſtas hydrargyri.
Tunſtate of molybdena.
Tunſtas molybdeni.
Tunſtate of nickel.
Tunſtas niccoli.
Tunſtate of gold.
Tunſtas auri.
Tunſtate of platina.
Tunſtas platini.
Tunſtate of lead.
Tunſtas plumbi.

T

New Names	Old Names.
Tunſtate of potaſh. *Tunſtas potaſſæ.*	
Tunſtate of ſoda. *Tunſtas ſodæ.*	
Tunſtate of tungſten. *Tunſtas tunſteni.*	
Tunſtate of zinc. *Tunſtas zinci.*	

W

Water.	*Water.*
Water, lime.	*Lime-water.*
Water, diſtilled.	*Diſtilled water.*
Waters impregnated with carbonic acid.	*Acidulous waters.* *Gazeous waters.*
Waters, ſulphurated.	*Hepatic waters.*

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